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L'OISEAU
ET LA
REVUE FRANÇAISE D'ORNITHOLOGIE

LE PROFESSEUR BERLIOZ
Volume Jubilaire



REVUE TRIMESTRIELLE
DE LA
SOCIÉTÉ ORNITHOLOGIQUE DE FRANCE
Rédaction : 55, rue de Buffon, Paris (Ve)

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AVANT-PROPOS

Depuis longtemps déjà la Société Ornithologique de France désirait manifester sa reconnaissance au Professeur Berlioz pour l'appui que celui-ci n'a cessé de lui prodiguer au cours de sa longue carrière au Muséum National d'Histoire Naturelle. Sa retraite officielle apporte aujourd'hui l'occasion recherchée.

Notre Conseil d'Administration avait d'abord envisagé de faire frapper une médaille à l'effigie de celui qui fut pendant si longtemps le titulaire de la seule chaire d'ornithologie française ; mais sa discrétion et sa modestie nous a fait penser que nous avions plus de chance de lui être agréable si nous lui dédions un fascicule de cette revue dont il dirigea si heureusement la rédaction pendant plus de vingt années.

Nous savions que dans ce but il serait aisé d'obtenir la contribution des plus grands noms de l'ornithologie contemporaine, mais des impératifs matériels nous obligèrent à rester dans des limites hélas bien modestes. C'est la raison pour laquelle nous ne nous sommes adressés qu'aux seuls Présidents et Secrétaires Généraux des Congrès internationaux d'ornithologie. On se rappelle en effet que le Professeur Berlioz présida lui-même le 12e Congrès, qui tint ses assises à Helsinki en 1958. A ces personnalités nous avons ajouté les ornithologistes des grands musées mondiaux, avec lesquels le Professeur Berlioz maintenait un contact permanent.

Les réponses favorables à notre appel furent si nombreuses et si sincères que nous fûmes amenés très vite à réaliser notre projet. Nous tenons à remercier ici au nom de tous nos membres ceux qui ont accepté de participer à cet hom-

mage envers l'un des leurs. Il faut voir dans ce généreux élan la preuve de l'estime générale dont jouit notre éminent collègue. Elle nous paraît d'autant plus justifiée que son attachante personnalité sait joindre à ses qualités professionnelles celles du cœur et de l'esprit.

Souhaitons que son amour des voyages d'étude et ses goûts d'indépendance ne l'éloignent pas trop souvent de nous, et qu'il puisse ainsi continuer à faire profiter notre Société de sa grande expérience et de ses profondes connaissances dans un domaine scientifique qui est le nôtre.

Le Président : F. Bourlière.

Le Secrétaire Général : R. D. Etchécopar.

LE PROFESSEUR BERLIOZ

par Jean Dorst
Muséum National d'Histoire Naturelle
(Paris)

En même temps qu'un grand honneur, c'est un devoir bien difficile que de présenter ce recueil d'articles rédigés par quelques-uns des représentants les plus qualifiés de l'ornithologie mondiale et publiés par notre Revue en hommage au Professeur Berlioz. Pour le Comité de Rédaction, ce fut une tâche bien plus difficile encore que d'établir la liste des personnalités à pressentir, car nombreux sont ceux qui auraient voulu y collaborer. Il a fallu notamment renoncer à la participation des ornithologistes français. Je le déplore à beaucoup de points de vue, car nombreux sont ceux qui auraient voulu apporter leur hommage à celui qui fut leur maître et auquel on doit le renouveau d'activité ornithologique au Muséum. En définitive n'ont été sollicités que quelques-uns des ornithologistes étrangers qui occupèrent des fonctions dans les Congrès internationaux en tant que Présidents ou Secrétaires généraux.

Ce n'est pas ici la place d'énumérer les mérites du Professeur Berlioz. Je voudrais simplement souligner ce que lui doit le laboratoire d'Ornithologie du Muséum. Fréquentant notre établissement depuis 1905, il y est entré comme jeune assistant en 1920. Il trouva l'ornithologie dans un état de sommeil, car le titulaire de la chaire, mammalogiste de spécialité, ne lui avait pas donné l'impulsion nécessaire. Dès 1926, le Professeur Bourdelle, dont il fut le collaborateur direct pendant plus de 20 ans, lui abandonna immédiatement l'entière responsabilité du département d'ornithologie. La tâche était énorme. Les collections, qui rivalisaient avec celles des établissements étrangers similaires du temps de Milne-Edwards, n'avaient guère été augmentées depuis et n'étaient

pas rangées comme elles auraient dû l'être. Pendant ce temps les grands musées d'outre-Atlantique avaient pris une avance qui rendait la comparaison peu flatteuse pour la France.

Patiemment M. Berlioz commença la détermination, le classement et le rangement méthodique des spécimens jusque-là entreposés sans grand ordre. Son attention se porta simultanément sur la collection publique, qu'il s'astreignit à rendre plus attrayante. Il en extraya les types en mettant ces « étalons » des espèces à l'abri des méfaits d'une exposition à la lumière et à la poussière. Ces collections anciennes du Muséum renfermaient également bon nombre de spécimens représentant des espèces actuellement disparues ou en voie d'extinction. Ses efforts permirent de disposer dans une salle particulière ce matériel précieux à l'occasion du Tricentenaire du Muséum en 1935. Un de ses grands regrets fut de ne pouvoir mener à bien une complète transformation des galeries publiques, faute de crédits et aussi du fait d'une certaine désaffection des autorités responsables. Ce travail reste à entreprendre, car c'est un devoir pour notre Maison que d'offrir au grand public des collections attrayantes, esthétiques et didactiques, moyen efficace d'enseignement populaire. La position du Muséum, encadré par les nouvelles Facultés des Sciences et des Lettres, augmente aussi nos responsabilités vis-à-vis des étudiants.

Mais une collection scientifique est morte si elle ne s'accroît pas continuellement. De grandes lacunes restaient à combler pour faire de nos collections nationales un outil de travail et une source de documentation universelle. M. Berlioz s'attacha à cet enrichissement. Une partie des apports nouveaux provint de quelques grands voyageurs et chargés de mission, avant tout de M. Jean Delacour avec qui se noua une collaboration très suivie. Une véritable campagne de prospection fut aussi entreprise parmi les collecteurs professionnels à travers le monde. De longues séries d'oiseaux affluèrent au Muséum, en provenance notamment d'Ecuador, du Mexique et de quelques pays africains. Des échanges réalisés avec d'autres établissements élargirent encore cet échantillonnage, pour faire des collections nationales le centre de documentation moderne et complet dont rêve tout conservateur.

Le Professeur Berlioz est cependant bien autre chose qu'un savant de cabinet. Naturaliste dans l'âme, il sait depuis toujours que c'est par le contact direct avec les êtres vivants

qu'on a le plus de chances d'apprendre la véritable histoire naturelle. Dès 1924, il entreprit de longs voyages à travers le monde et, à part l'Océanie, il est peu de régions qu'il n'ait parcourues. L'Amérique du Sud, puis surtout l'Asie, retinrent plus particulièrement son attention, cette dernière partie du monde ayant pour lui le charme supplémentaire de peuples de haute culture et de civilisations millénaires. Il recueillit ainsi au fil des années une documentation considérable sur la répartition et les mœurs des oiseaux, des autres animaux aussi, en même temps qu'il nouait des contacts fructueux pour notre Maison avec des correspondants répartis dans le monde entier.

Cette double orientation, motivée par deux tendances complémentaires, détermina ses recherches personnelles. Collectionneur dans l'âme, il est avant tout un systématicien, car il sait que, si la systématique est le début de toute science naturelle, elle en est aussi la fin. Beaucoup de ses travaux — en tout plusieurs centaines — ont porté sur la taxinomie ornithologique. Il a décrit de nombreuses formes nouvelles. Et si les Trochilidés ont retenu tout spécialement son attention, l'ensemble des oiseaux n'a pas échappé à ses investigations, avec toutefois une prédilection affirmée pour ceux des régions tropicales, encore relativement mal connus. Un tableau d'ensemble de la systématique ornithologique fut dressé sous sa signature dans le Traité de Zoologie du Professeur Grassé.

Une autre partie de ses travaux porte sur la biogéographie, science vers laquelle le portaient ses goûts et ses connaissances de terrain. Après avoir étudié une avifaune, il se plaît à en étudier la composition, à préciser ses affinités et à démêler la manière dont elle s'est formée, sans jamais se lancer dans les hypothèses hasardeuses de « science-fiction » où se plaisent beaucoup de biogéographes. Le réel a toujours plus d'attrait pour lui que la projection dans le passé ou l'avenir.

Les voyages du Professeur Berlioz lui avaient aussi appris à quel point la nature était menacée dans le monde et partout il avait constaté avec anxiété la régression de la faune et de la végétation devant l'avance de la civilisation technique. Ses missions au Canada et aux États-Unis lui avaient montré, dès 1924, combien ces pays étaient en avance sur nous dans le domaine de la protection des espèces et des habitats sauvages.

Aussi devint il un ardent apôtre de ces idées, nouvelles à cette époque en France. S'il fut un des premiers à les diffuser dans notre pays, son intérêt pour ces questions n'a jamais faibli, comme le démontre une participation active et suivie à tous les mouvements de défense de la nature.

Mais le Professeur BERLIOZ est plus que cela encore. C'est un naturaliste complet, formé à la Faculté de Pharmacie et à celle des Sciences, où il s'est imprégné de toutes les disciplines dont le large faisceau forme les sciences naturelles. Il a continué à s'intéresser à beaucoup d'entre elles et ses connaissances en botanique et surtout en entomologie ne le cèdent guère à celles qui lui sont nécessaires pour sa vie professionnelle. Ce qui est beau l'attire plus que le reste, et ce n'est pas en vain que ses préférences vont aux Oiseaux-mouches, aux Cétoines, aux *Papilio* et à quelques minéraux. Mais les autres groupes ne l'intéressent guère moins et nul sans doute plus que lui n'a ressenti l'unité du monde vivant et la nécessité de ne pas en dissocier une partie si l'on veut comprendre les phénomènes de la vie et la place de chaque être dans la communauté.

Les charges du Professeur BERLIOZ ont été lourdes. Pendant de longues années les crédits furent mesurés ; l'expansion scientifique, lente dans l'ensemble en France, ne touchait guère les disciplines fondamentales jugées archaïques. Il eut donc à lutter pour accroître les collections et dégager les crédits nécessaires à leur présentation.

Quand il prit la direction de la chaire, nous sortions de la période difficile de la guerre et les années qui suivirent les arrêts des hostilités ne le furent guère moins. Ici encore il s'agit de trouver les fonds nécessaires à la reprise des activités normales du laboratoire et à son développement. Il s'y employa sans faire de bruit et en dépit de multiples écueils développa le laboratoire en donnant à ses collaborateurs les possibilités de travail qui avaient fait défaut à leurs prédécesseurs.

Le renom des travaux du Professeur BERLIOZ, les contacts qu'il avait pris à travers le monde, lui valurent de nombreux honneurs qu'il n'avait jamais recherchés. Membre d'honneur de toutes les grandes sociétés ornithologiques du monde, il fut appelé en 1958 à présider le XII[e] Congrès international d'Ornithologie réuni à Helsinki. L'adresse présidentielle qu'il adressa à cette occasion reste présente à l'esprit de tous, car

elle synthétise un aspect important de sa pensée : le rôle des collections dans l'avenir de l'ornithologie. Il insista sur le rôle des spécimens de collection comme base la plus solide de nos connaissances relatives au peuplement animal et à son évolution actuelle. Sans mettre en doute la valeur des études de terrain et de la biologie expérimentale, il affirma que celles-ci sont vaines si elles ne reposent pas sur les solides connaissances systématiques que seules peuvent donner des collections. Cet appel résonna longtemps à une époque où l'on glissait vers des routes sans issues. Le renouveau actuel de la systématique ornithologique, en particulier aux Etats-Unis, lui donne entièrement raison.

Le Professeur Berlioz a aussi su depuis toujours qu'un chercheur reste sans grande action s'il ne sait pas s'entourer d'élèves et de collaborateurs formés à son école. Il a su susciter des enthousiasmes autour de lui. Les jeunes n'abordent le Muséum qu'avec un respect qui touche à la crainte tant l'atmosphère leur paraît chargée de science et d'austérité. Il a su leur parler, les mettre à leur aise, les placer en face des problèmes et leur confier des collections sous sa garde rigoureuse, pour apprendre et étudier. Il n'a pas craint de perdre un temps précieux que d'autres maîtres auraient consacré à la recherche ou à courir après de vains honneurs. Il les a formés à la dure école du laboratoire, et a toujours compris que ses élèves s'échappent sur le terrain, munis de la formation solide qui ne s'acquiert que par la manipulation de spécimens. En dépit d'opinions solidement établies, il a toujours admis la contradiction et les longues discussions, souvent animées, qui eurent le laboratoire pour théâtre, apportèrent beaucoup à ses interlocuteurs. Les hommes de science sont souvent personnels, exclusifs, voire égoïstes. Le Professeur Berlioz est exactement le contraire et ses jeunes élèves — ou ceux qui furent jeunes — lui savent gré d'être un maître compréhensif, sensible, parfois taquin, en même temps que ferme et érudit.

C'est en témoignage d'estime, d'admiration et de respectueuse affection que les pages de ce fascicule ont été écrites. Elles ne marquent pas la fin d'une carrière. Car un naturaliste du Muséum n'est jamais à la retraite. Il arrive un âge où la société le décharge de ses obligations administratives, un devoir combien pesant pour un homme dont la vocation fut déterminée par la recherche et non par la rédaction de

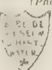
rapports et de demandes de crédits, de préparation de budgets et de bordereaux de service. Un naturaliste continue toute sa vie le même travail, pour sa satisfaction personnelle sans doute, mais surtout pour connaître et faire connaître aux autres quelques-uns des secrets de la nature. Nul ne le fait mieux que le Professeur Berlioz. Il y a quelques jours je le voyais étudier avec passion une collection fraîchement arrivée du Pérou. Il est certain que son enthousiasme était le même que celui dont il témoignait quand, jeune néophyte, il pénétra dans la vieille maison de la rue de Buffon qu'il a su rénover dans le respect des traditions.

Le Professeur Berlioz a su faire œuvre de naturaliste et de chef d'école. Faisant alterner travail en laboratoire et longs voyages à travers le monde, il a su mener une vie heureuse et calme, en même temps que fructueuse et stimulante pour ceux qui l'ont entouré, un cas rare dans notre monde moderne.

Ce recueil de travaux ne fait que marquer une étape de sa carrière. Au nom de la Société Ornithologique de France, au nom de tous ses collègues, de ses amis et de ses élèves, je le prie de bien vouloir l'accepter comme hommage de respect et d'affection.

Le Professeur BERLIOZ photographiant des Protéas à Somerset West, Province du Cap, Afrique du Sud, en septembre 1956

(Photographie G. J. Broekhuysen)



NOTES ON THE GALAPAGOS HAWK

by Dean AMADON
American Museum of Natural History, New York

(Contribution n° 40 de la Fondation Charles Darwin pour les Galapagos)

During field work in the Galapagos Islands in January and February 1964 while a member of the Galapagos International Scientific Project sponsored by the National Science Foundation, Grant Number GE 2370, and by the University of California, Berkeley, special attention was given to *Buteo galapagoensis*. Observations were carried out on this raptor at Punta Espinosa on Fernandina (Narborough) Island, January 26-February 5 ; above Tagus Cove, Isabela (Albemarle) Island on January 30th ; on Española (Hood) Island from February 15-20 and finally for a couple of hours on Santa Fe (Barrington) Island on February 20.

During two weeks or so on Santa Cruz (Indefatigable) this hawk, which is now rare, at least in the settled portions of that island, was not seen. Robert Pyle of our party did see one in the highlands.

RELATIONSHIP OF THIS SPECIES

A special interest in the systematics of hawks may serve as an excuse for commenting on this question at some length. RIDGWAY (1875) divided the genus *Buteo* into two subgenera, separated primarily by whether three, or four, outer primaries are notched. *Buteo galapagoensis* has three primaries notched and was placed in a subgenus *Craxirex* Gould, an exclusively American group, whose other species are *platypterus, swainsoni, albicaudatus, polyosomus* and (if a species) *poecilochrous*. The last four species named, along with *galapagoensis* constitute, I agree with RIDGWAY, a natural unit,

indeed they may be a superspecies. *Buteo swainsoni*, is much weaker footed than the others, and it is probably a mistake to regard it as the closest relative of *galapagoensis*

Ridgway placed all the other species of *Buteo*, including all the Old World ones, in the nominate subgenus, characterized by four notched primaries.

It may be remarked, parenthetically, that, as a practical matter, the use of this character is not always as easy as it sounds, particularly in museum skins Many specimens have the outer primaries in molt ; the notch on the feathers becomes less pronounced in worn plumage, and some individuals and, I suspect, even species may be intermediate. To illustrate these difficulties Ridgway placed *Buteo brachyurus* in the group with four notched primaries ; the few I have examined seem to have only three, but perhaps I have yet to see one in first class condition

I should also add that Ridgway (1873) recognized a genus *Rupornis* (five primaries notched) with species *magnirostris* and *leucorrhous* and a genus *Asturina* (four primaries notched) for the species *nitidus*. These three species are now generally, and I believe correctly, included in *Buteo*, but they admittedly (especially *nitidus* and *magnirostris*) are somewhat intermediate towards some of the seemingly primitive buteonine genera, notably *Leucopternis* and *Buteogallus*.

If the above remarks are correct, a phylogenetic arrangement of the species of *Buteo* would begin with the three species just mentioned, then the large four-notched group, and finally the three notched « *Craxirex* » group This does not seem very satisfactory The four notched group, including all the Old World species and such New World ones as *jamaicensis* and *regalis*, seems to represent the more advanced segment of the genus. This group seems to be the most like the related, more advanced « booted » eagles of such genera as *Spizaetus*, *Hieraaetus* and *Aquila*. One is led to suggest that the number of notched primaries may not be a very good clue to relationship. An examination of all the buteonine and aquiline genera of the family will, I believe, convince anyone that such is the case, though I shall not tabulate extensive evidence This is not to say that the character is of *no* use ; it is one of the features showing the *Craxirex* group to be a monophyletic unit. It will also, of course, remain a useful

aid in identifying some puzzling specimens, for exemple, certain immatures of *swainsoni*.

JOHNSON and PEETERS (1963) have recently set up a group of (American) woodland buteos, with the species *magnirostris, ridgwayi, lineatus platypterus* and *nitidus*. They do not mention the question of primary-notching but obviously consider it of no importance, since their group contains species of each type, e. g., *lineatus* (4), and *platypterus* (3). As already intimated, I agree that this character is probably not always significant, but it has entered into discussions of the genus so extensively that it can hardly be ignored.

JOHNSON and PEETERS have not mentioned either *Buteo leucorrhous* or *B. brachyurus* (and *albigula*, if specifically distinct from *brachyurus*). The former I would think surely and the latter probably should be associated with their group.

In the overall arrangement of the genus *Buteo* I would begin with this « woodland » group with the additions noted ; follow it by the « *Craxirex* » group, which may be regarded as a natural group of fairly primitive buteos which happen to have three primaries notched, and finally come the remainder of the genus beginning with such slightly aberrant species as *albonotatus* and *solitarius* and concluding with the Old World and African ones.

So far as the sequence of the « woodland » group is concerned, it should begin, not end, with the aberrant *nitidus*, which, as noted above, provides a link with *Leucopternis* and, in the immature, *Buteogallus*. Some may argue that RIDGWAY was correct and that the similarity of *lineatus* and *platypterus*, for example, is the result of ecological factors. While this may be true, we do have the fact that they are very similar and live in the same part of the globe. I would thus suggest the following sequence of species for the genus *Buteo* : *nitidus, magnirostris, leucorrhous, ridgwayi, lineatus, platypterus, brachyurus, swainsoni, galapagoensis, albicaudatus*, etc.

HABITS

After reading of the tameness of the Galapagos Hawk and of how it eats centipedes and carrion, I had expected a sluggish, inoffensive bird. During the breeding season, at least, it is actually a vigorous, noisy species and, as will be

seen from the section on food below, it catches some large prey. In these respects it is to be compared with such a species as the Red tailed Hawk, *Buteo jamaicensis*.

In physical appearance also, the Galapagos Hawk is a more impressive bird than I, at least, had expected from examination of frowzy museum specimens, often in immature plumage. As is now known, the adult plumage is always black ; phases do not occur. In the hand it is a rather brownish black, but this is not apparent in the field. In a pair under observation in the field the male seemed blacker than the female, but examination of specimens indicate that such is not consistently the case.

Food

Fernando Ortiz, an Ecuadorian student in our party, called us to see a hawk that had just caught a young marine iguana *(Amblyrhynchus cristatus)* and carried it to a dead mangrove where it was eating it. The reptile was perhaps 40 centimeters long and presumably from the previous year's hatch. The hawk consumed everything except the tail and a portion of the entrails.

Ortiz said that the hawk had not carried off the reptile in a clean swoop but had rather flopped about grappling with it ; somewhat below the surface of a large lava fissure. The hawk failed in the first attempt, then tried again and was successful (very likely with another individual iguana for there are hundreds of them on this rocky point).

During our stay on Punta Espinosa the egg laying period of the iguanas commenced. The females trudge about on the sandbars and eventually begin to dig a nesting burrow. On the morning of February 3 as we were watching half a dozen or so thus occupied, an adult hawk came flying by. Immediately intrigued by this display of exposed iguanas away from the lava to which they can cling, it lit on the sand among them, then ran about four meters and seized one by the back with both feet The presumably painfully astonished iguana rushed away, dragging or carrying the hawk. The latter, evidently accustomed to carrying its prey rather than the reverse, released its grasp and flew to a lava outcrop a few feet away. After surveying the situation, it flew off. For a

photograph of a hawk (probably one of the pair I studied) with an iguana as prey see LEVEQUE (1963).

Both of these instances suggest that the marine iguanas even when young are at about the upper limit of prey size for the hawk, and are handled somewhat gingerly That the observed instance of predation was not an isolated one, is shown by the remains of a young marine iguana found in the nest of the hawk and another on lava some distance away.

Dr Herndon DOWLING of the New York Zoological Society has assumed that this hawk also preys upon the young of the land iguana, *Conolophus*. There is no reason to doubt this, although, unlike its marine relative, the land iguana bites viciously. Nevertheless, it is a rather clumsy creature and a young one would probably have little chance of seizing a hawk. Ross KIESTER, a herpetology student at the University of California, told me that he tied the legs of an adult land iguana (on the uplands of Fernandina, their only real stronghold today) to immobilize it When he returned to pick it up, a hawk was perched on the ground beside it, but had not attacked it as yet. Such behavior, of course, might be expected in almost any predator, quick to observe that a creature is in distress.

On Santa Fe Island there is a small surviving population of land iguanas, composed mostly of old adults. Young individuals are very seldom seen This island is infested with feral goats which have greatly thinned out the vegetation. Hawks are common DOWLING (1964) has suggested that under such circumstances the hawks may catch enough of the young iguanas exposed by the grazing of the goats, to lead to the extirpation of the species. This is possible, but it seems likely that the goats might well have the same result eventually, even if hawks were absent. At any rate, all agree that it is the goats, not he hawks, that should be removed.

Among the debris about a hawk nest was a skull and other bones of a full grown Galapagos Green Heron, *Butorides sundevalli*. This species is slightly larger than the mainland *B virescens* and *B. striatus* and is another indication of the fact that *Buteo galapagoensis*, like so many of the birds of these islands, utilizes an extraordinary range of food Whether the scarlet crabs, *Grapsus*, which are so superabundant along the shore line, are utilized by this hawk is still

not certain. Beneath the feeding perch where the hawk ate the iguana, there were scattered pieces of the shell of a crab or two on the sand. We thought they had probably been eaten by the hawk.

On January 30, during a day spent on the high ridges above Tagus Cove, Isabela Island, one or both of a pair of hawks was in view much of the time. One of them was observed to hunt in a method that is very common in *Buteo polyosoma* and *B. albicaudatus*. This is to pause or hover at a considerable elevation, then, if no prey is discerned, to glide over to a new station 100 meters or so away and repeat the careful inspection of the ground beneath. This seems very definitely to be a method of systematically examining the ground below for food. The distance which the bird travels before again hovering is more or less the same each time. Thus this method of hunting differs from the hover-hunting of the American Kestrel (*Falco sparverius*) in which the bird, quite definitely, stops to hover only after it spies something interesting on the ground below.

In the instance mentioned, though I have used the word « hover », a stiff breeze was blowing and the hawk merely hung motionless without flapping its wings. Even so, the wind was strong enough so that the bird's tail was not infrequently flipped above its back.

The hawk in question was hunting at what seemed to be a rather remarkable height above the semi-arid, sparsely brush-covered slope below, perhaps 50 meters. One could scarcely expect it to see locusts at this elevation. Lava lizards (*Tropidurus*) were present though scarce, presumably because of a prevalence of feral domestic cats and may have been the prey sought. On Punta Espinosa, a hawk was seen carrying in flight one of the endemic snakes *Dromicus*, which are common in the area.

Voice

The usual cry of alarm or excitement is a loud, harsh scream « *keer* » uttered several times in succession and occasionally hurried so that it becomes almost a whinny. The voice is thus not unlike that of *Buteo lineatus* but is rather different from that of such species as *B. jamaicensis* and *B. swainsoni* which utter longer screams singly

During coition a softer cry, *kirp, kirp, kirp*, or *klilp, klilp, klilp*, audible for at least 75 meters, is given continously. I thought only one sex did this, but as noted elsewhere, could not be sure

Nesting Habits

When we arrived on Punta Espinosa, Fernandina Island just at dark, a hawk was perched on a dead mangrove out on the point. It flew away to roost in the gathering darkness. It returned to the same perch early the next morning. This was an immature bird which together with a nesting pair of adults seemed to comprise the population of the species on this part of the island. The immature bird was never seen with the adults except on one occasion. Then, a third bird, presumably this immature, joined the soaring pair of adults for a few minutes before veering off.

It is perhaps worthwhile to summarize our day by day observations of the breeding pair, as an example of an interrupted breeding cycle.

January 26. As I entered a clump of mangroves 50 meters from camp to store film, I became aware of the pair of buteos circling just above, screaming. I emerged to watch and saw them circling about, from time to time dropping into the mangroves, once one with legs dangling. Then one landed on an exposed perch, on top of a mangrove. The other followed. The male, noticeably smaller flew off. A few seconds later the male returned and copulation took place immediately. A one syllabled call, *kirp, kirp, kirp*, softer than the usual scream, was uttered continuously, but neither on this or later occasions was I able to tell by which bird.

During the morning of this day, Dr. A. H. Miller said he had visited the nest, which C. C. Carpenter of our party had found in use two years before. The birds had protested vigorously. Sr. Ortiz also had visited the nest and again the old birds had reacted strongly. In the afternoon I looked for the nest and found it to be about a kilometer from camp. It was on the first ridge of lava, where the smoother lava near the shore gives way to very rough, sharp lava that leads away at a slight slope toward the main volcano which comprises Fernandina. Built of white, barkless, bleached man

grove sticks from shore drift, the large nest was very conspicuous. The nest twigs spilled over somewhat onto a lower level of lava. Except for the extremely rough, unstable footing, the nest is easily reached. I found one egg in the nest. It was completely covered by two or three fresh sprigs of mangrove. I had the nest in view from about 1 . 30 to 2 · 15 p. m. but saw nothing of the parents. It was very hot, and I wondered if the egg could resist the heat even though covered by the mangrove leaves. However I concluded from the behavior of the birds that the egg had probably been laid very recently. I did not see the birds again all day, but they were observed mating on at least two occasions by others of the party.

The nest, when first examined, appeared as though the two or three rather short leafy twigs of mangrove had been placed directly over the egg thus concealing (or shading) it. It did not look as though the green leafy sprays had been merely dropped on the nest, though this seems usually to be the case in those numerous species of hawks that bring such green material to their nests. The extent, if any, to which hawks « deliberately » cover their eggs requires investigation. If the habit exists it has rarely been mentioned by naturalists. Yet A. C. BENT (1937, p. 323) wrote as follows of a Bald Eagle's (*Haliaeetus leucocephalus*) nest he examined : « No eggs were visible, but I found them deeply buried under fully 2 inches of the soft lining, completely concealed ; the eggs had evidently been covered by the eagle when she left the nest. » I have spoken with individuals who have examined numerous nests of this eagle without noticing such behavior. In a recent note on *Parabuteo unicinctus*, a close relative of *Buteo*, it was stated of the three eggs : « These had been covered with strips of inner bark, presumably by the parent bird which was not incubating at the time » (PARMELEE and STEPHENS, 1964). One of these eggs later hatched, so it is known that the nest had not been deserted. With hawks there is, of course, always the possibility that an incubating bird will inadvertently drag some of the nest material over the eggs as it leaves the nest.

To revert to the Galapagos Hawk, I doubt that the eggs could stand exposure to the sun during the heat of the day for any length of time. Even though incubation in some hawks is said to begin with the laying of the first egg, cove-

ring of the egg or eggs with green leaved twigs and or nest lining would have adaptive value. Whether such a habit does in fact exist in any hawk requires confirmation.

January 27 Ortiz and I worked our way slowly down to the hawk nest, busied with other observations on the way. Reaching the nest about 9 . 45, there was still the one egg, covered by the leafy mangrove twigs. When I lifted them, the leaves were wet beneath. This had kept the egg cool although by now the sun was becoming warm. Ortiz called my attention to one of the hawks sitting in the top of a dead mangrove by the shore, perhaps 100 meters away. this proved to be a favorite perch). A mockingbird, *Nesomimus trifasciatus*, sat on another dead branch 3 or 4 meters away. They often mob the hawks (if it is possible for one or two individuals to « mob »). Later, as we walked down the shore, a hawk, perhaps the same one, flew by and screamed once or twice. It occurred to me this morning that the nest may have been deserted, unlikely as this seems. This hawk is, like most other Galapagos creatures, very tame. But that does not mean that, if the nest is visited on several occasions on the very morning when the first egg was laid, the parents might not desert. Swarth (1935) pointed out that the Galapagos dove, *Nesopelia galapagoensis*, has a strong distraction display even though, he thought, it has been superfluous ever since the dove's ancestors reached the islands, some tens or hundreds of thousands of years ago. Thus behavioral traits, strongly embedded in the genotype, are perhaps sometimes retained almost indefinitely, just as are physical traits (Mayr, 1963, p. 288. A. H. Miller however doubted that the egg was fresh and pointed out that it was nest stained. However, the midday sun literally cooked the juice from the fresh mangrove leaves above it, and this may have stained the egg quickly.

I did not see the hawks again on the 27th, but Professor Carpenter saw one of them swoop down and carry off a young marine iguana.

January 28. Visit the nest at 8 a. m. Already the sun is getting hot. The mangrove leaves in the nest are now quite wilted. Am now convinced the nest is deserted. One of the hawks, however, perched for a few minutes on the high

branch near the shore, then flew silently down into the mangroves.

January 29. — As I walked down the foreshore towards the nest, one of the hawks flushed from the ground. It flew to a perch about two meters high. A mockingbird flew to a nearby perch and scolded once. I reached the nest a little later at 10 a. m. Just as I was examining it, a couple of weak screams called my attention to one of the hawks on the high mangrove perch. Apparently the birds, or one of them, retain a mild interest in the nest. The now dry mangrove leaves and twigs which once covered the egg had blown away.

12 : 30 p. m., Male hawk diving and screaming, as female perches in a tree.

1 p. m., Pair high in air, facing motionless into breeze ; one or both screaming. Soon one, presumably male, circled higher, then descended towards soaring female, with legs dangling. Both soon glided off and eventually disappeared behind a clump of mangroves, screaming loudly.

It would seem the pair, after abandoning nest, is coming into the active mating phase of the cycle again.

January 30. — (Absent from area).

January 31. — Visited nest. Hawks not present. Egg still in nest. One hawk seen later in morning catching and eating young marine iguana.

February 1 and 2. — (Absent from area).

February 3. — 8 : 30 a. m., The two hawks fly to adjacent perches in a dead mangrove. Both preen and clean their beaks. 8 : 38, Female flies to another snag 50 meters off ; soon drops to a lower limb, legs dangling and perhaps soliciting male who continues to perch stolidly. 8 : 40, Female leaves perch ; when she has covered 5 meters or so, the male leaves his tree and follows, screaming loudly. They are quickly lost from sight, but a little later I observe them screaming and plunging in the distance.

9 : 55, Both hawks back on original perches. Male soon departs. Female remains on a half concealed perch, occasionally changing directions. Perhaps she is looking for prey, but the low mangroves below are so dense it seems a poor

hunting place. 10 : 40, Male appears silently and perches about 3 meters from female. After a few seconds, he hops to perch half that distance away, then to side of female and coition follows at once.

The male soon flies off, followed by the female. They soar and flap about, with some screaming. The female returns to perch in the same tree, where she screams occasionally. A little later I see three birds circling high, at least one of them screaming , but one of them probably the immature that is in the vicinity) soon scales off by itself.

(Later this morning, one of the adults, probably the female, had the encounter with nesting iguanas described earlier.)

February 4. 1 p. m., One hawk perched on highest branch of tall, dead mangrove. Flies off behind some trees, but a minute or so later, two hawks come flying back to same perch and copulate immediately, one or both uttering a high pitched, repeated *klilp*, audible when I am, perhaps 100 meters away. Both preen, the female more vigorously.

1 : 10, Again copulate, then resume preening. Five minutes later the female hops to a perch close to the male. A few minutes later she fans her tail feathers, stretches one wing and turns towards her mate.

1 : 30, The female flies off ; and when I look a minute or two later, the male has gone also.



The remarkable fact to me was that the pair had resumed active sexual behavior without being seen near the nest, which still held the deserted egg. Possibly, however, the female would simply have laid in the nest, without further preliminaries, except, possibly, to push out the old egg.

It was considered unlikely that the pair had another nest, as our party scoured the entire area rather thoroughly.

Lack (1950, p. 273) considered the Galapagos buteo a breeder during the « cool, dry, season » and found records of eggs from April through August. Lévêque (1964) found that with increased data the nesting season of many Galapagos birds, including the hawk, is more prolonged than was

previously believed. He knew of egg records for *Buteo* in April, June, August, and December. We have added January and probably February (pair mating, Santa Fe Island). During the same period a pair observed on Española, showed no evidence of nesting beyond the fact that the birds tended to stay together.

The ecology, including climate, varies tremendously on the islands. Even on a single island, one goes from semi-arid lava desert to wet highland forest. In some years there is more rain than in others. The hawk is found in a variety of habitats. Further studies may show, however, that there are local regularities in the season. Especially on low, relatively unvaried islands such as Española, the hawks may have a definite season, perhaps correlated with cycles in some staple food. Or it may be that there is no definite season of reproduction and that nesting is on some non annual cycle for each pair, or is irregular and triggered by the food supply.

RESUME

Monographie de la Buse des Galapagos (*Buteo galapagoensis*).

Position systématique et comportement. Cette seconde partie fait état des résultats de la mission patronnée par la *National Science Fondation* et l'Université de Californie de Berkeley.

L'auteur consigne ses observations personnelles, faites en janvier, février 1964, sur cette espèce jusqu'ici mal connue : nourriture, voix, reproduction. Sur ce dernier point, nous trouverons une série de notes particulièrement intéressante, prises quotidiennement au cours de la reproduction d'un couple sur l'Ile de Fernandina — copulations, nids, œufs. Malheureusement cette observation n'a pu être menée à bien jusqu'au bout.

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SOME REFLECTIONS ON TWO RECENT VISITS TO THE AZORES ARCHIPELAGO

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At 7 p. m. on the 29th May 1963, the Portuguese mailboat CARVALHO ARAUJO, due to have sailed four hours earlier, edged her way out of Funchal harbour and set her course for the Azores, a group of islands to which I had always hoped fate would some day bring me, though my hopes were not to be realised until the eventide of life It was already beginning to get dusk as we passed the great cliff of Cabo Girão rising close on 2,000 feet sheer from the sea, from the summit of which we had once watched several huge sting rays (*Trygon pastinaca*) in the clear waters at its foot. As the dinner bell sounded we were approaching Ribeira Brava and when later we came up on deck the daylight had gone, the twinkling lights from the villages on the mountain side were all that remained, and the flashing beams of the lighthouse on Ponta do Pargo was the last we saw of Madeira as the CARVALHO passed from the shelter of the land to the open sea.

The weather was all it should be and the voyage to Santa Maria, the first island to be visited, was over almost before we had realised our trip had begun. It was our intention on this occasion to visit as many of the nine islands which compose the Archipelago as circumstances would allow, for landing and re-embarking even in a normal sea is not to be lightly undertaken where there is no harbour, and when the rise and fall of the waves is always considerable. Only at Ponta Delgada in São Miguel and at Horta in Faial are there really first rate harbours, in all the other islands, Santa Maria, Terceira, Graciosa, São Jorge, Pico, Corvo and Flores, the vessels loading or unloading stand out to sea and passengers as we were warned go ashore at most of the little ports

« at their own risk ». We were to consider ourselves very lucky that only on Graciosa and São Jorge was it impossible to go ashore. In the course of her leisurely journey around the islands the CARVALHO ARAUJO visited each island twice, both on the outward journey to Flores and on the return. Sometimes the visit was for the whole day or two days according to cargo, and sometimes less, but it gave us the opportunity to obtain a much better idea of the bird population than such brief visits would suggest. A fascinating account of these islands and their bird life could be written by a visiting naturalist with a gifted pen for description, but in this short article in which I was restricted to « five pages » of *L'Oiseau et la R. F. O.* only the high lights of our voyage can be mentioned, and only general impressions given. We have returned again in the autumn of 1964 to São Miguel, where we have stayed another five weeks, having set ourselves the problem of discovering if the priôlo — the endemic bullfinch of the island — still exists anywhere in the remotest forests, but of that more will be said later.

I was already familiar with Azorean literature and many years ago in the British Museum had made a study of the specimens collected in the Azores by F. Du Cane Godman, and later by W. R. Ogilvie-Grant, whose published reports on their collections — remarkably complete ones so far as the resident birds were concerned — were the foundation upon which others following afterwards have built. On this first voyage, accompanied by my wife, we were to form some very definite impressions of the status of the Azorean birds and of the work which remains to be done, for *field work*, as apart from collecting for which there is no more need, has been sadly neglected. The first thing which strikes the visiting naturalist is the paucity of resident land birds, and the number of species which one might expect to find, which have never occurred. A few species are dominant and widespread and these can be counted on the fingers of one's hands ! Chaffinches, only one race occurs (*Fringilla coelebs moreletti*), abound everywhere, and of the other *Fringillidae*, Canaries (*Serinus canarius*) are equally numerous. Grey Wagtails (*Motacilla cinerea patriciae*) were seen on every island from the coast to the higher elevations. Redbreasts (*Erithacus rubecula*), Blackbirds (*Turdus merula azorensis*) and Blackcaps (*Sylvia atricapilla atlantis*) were constantly in evi-

dence and wherever the heaths or pines were prominent we were sure to see Goldcrests (*Regulus regulus*), the only bird in the Archipelago be it noted of which more than one subspecies has been described. There are in fact three. All other land birds, except those enumerated above, are relatively uncommon, except perhaps the insular Quail *conturbans*) which, owing to the number of eggs produced in a season, and difficulty of flushing, is able to hold its own, while some other species are quite definitively dwindling. One bird of which we saw a number on the western and central islands, but which appears to be absent from Corvo and Flores, is the Buzzard, a small dark endemic race which was named in honour of the late Lord Rothschild (*Buteo buteo rothschildi*) It is said to have been once very numerous and is believed to have been the bird which the first discoverers of the islands mistook for the Goshawk, the « Acor » of Portugal, after which the islands are named As no Goshawk (or Kite) has ever been reported from the islands the inference is reasonable.

Starlings (*Sturnus vulgaris granti*) which we met with in varying numbers on Santa Maria, S. Miguel, Terceira, Pico, Faial, and Corvo, though not seen by us on Flores, were relatively common. The sub specific distinction of this Azores starling has recently been questioned by an American.

During our travels in the various islands we formed the opinion that not more than ten land birds could be reckoned as really common ! The numbers of these was sometimes striking, as in the case of the Chaffinch, Wagtail and Canary, but there are other birds present, though much less in evidence : Goldfinches (introduced) and Greenfinches (also reported introduced and Spanish red-legged partridges which must at one time have been imported from somewhere north of the Douro judging by the brilliance of their plumage and russet-hued mantles, but these birds are not encountered by the casual visitor, and the finches are both definitely rare and local at the present day. The Azores can claim only one resident Owl and that the long-eared. The few specimens collected show no distinction from mainland *Asio otus otus* which is rather surprising, as they must have been resident in these Oceanic islands for a great many years and are unlikely to have reinforcements arriving from the Continent. Of the endemic races which must be conside-

red to be nearing extinction the Azorean wood-pigeon (*Columba palumbus azorica*) is unfortunately one, while the Azorean bullfinch (*Pyrrhula murina* of Godman, is close on the verge. This bird and its status in São Miguel, if it still existed, was the real object of our return to the Azores in the autumn of 1964, and this seems to be the proper place in this brief article to recount the result of our enquiries Armed as we were with a coloured plate of the Bullfinch by Mr David Reid Henry, we were in a better position to tackle local opinion and interview those reputed to have known the bird in olden days than we were during our first visit in June of the previous year, when we searched the slopes of the mountains above the lake of Furnas and the orchards by the little stone-built chapel on the shore whence had come the last examples ever to have been obtained in 1927.

The Priôlo — by which name it is generally known — has always been restricted to the eastern provinces of S. Miguel and occurs nowhere else in the world. In the year 1865 F Du Cane Godman collected what specimens he needed in a poplar tree in the space of a few minutes, the report of a gun did not alarm it, so tame was it reported to be - or so unused to firearms. Its refusal to spread beyond its immediate habitat, the orchards and forests east of Furnas, points to its sedentary habits and its attachment to a particular terrain. Its fondness for peach and other fruit blossom is the real reason why it has been reduced to a few pairs. That it still exists in the more inaccessible forest patches my wife and I, after endless enquiries on the spot, and meetings with those who have known it in the past, feel reasonably sure. It was, however, mostly the older men who recognised the coloured pictures of the Priôlo which we carried with us, those of the younger generation had obviously no personal knowledge, but that it had been actually seen within the last two or three years by responsible persons of middle age was our final opinion. Search for it as we did in ravines (ribeiras), mountain glades, Cryptomeria forest, orchards, heather-clad slopes, and on private estates where it had been reported as occurring within recent years, we never saw anything which we could definitely assign to the Priôlo More than once a bird would cross our path to disappear all too suddenly into thick growth which had the flight and appearance of a bullfinch, but in no instance were our

hopes fulfilled, and we left the area where it is reported to occur with the conviction that the only chance of seeing it would be when the orchards are gay with blossom and the birds have vacated their winter retreats, wherever they may be, to feed on the fruit-buds.

The total extinction of the Azores bullfinch — when it takes place — must not be attributed to collectors of skins for preservation in Museums, but unquestionably to the islanders themselves who took every opportunity to slaughter the birds on account of the damage done to the fruit trees, ridiculously unafraid of man as it was reported to have been. There are grounds for believing that a reward was offered for every bullfinch beak produced to the local agricultural authorities, and with every man and boy (the latter armed with catapults) on the watch for it, its days of plenty were very soon numbered. As the only endemic species in the whole of the Archipelago, its extirpation will be a tragedy which it seems impossible to prevent. Once a species is reduced to such low proportions it is almost impossible for it to recover.

São Miguel where the Bullfinch has its home is the island in which most bird research has been carried out and to which visiting ornithologists of other nations have been attracted, but interesting though this large island undoubtedly is, with its crater lakes and varied scenery, the other islands of the group all have their particular charm. In Ponta Delgada, the capital of São Miguel, the very excellent Museum « Carlos Machado » is a natural rendez-vous for foreign visitors, and is under the capable honorary directorship of Senhor José Maria Alvares Cabral. He has already done wonders in re-organisation and the determination of specimens under his charge and by seeing that all newly acquired material is properly recorded and labelled. We were greatly impressed by his ability. The Museum has suffered from having far too many extra-limital exotic species on exhibition, with the result that the cases are all overcrowded. This is a legacy which Senhor Alvares Cabral is doing his best to remedy since he has been in charge.

From São Miguel the CARVALHO ARAUJO set course for Terceira, the first of the five in the central group of islands to be visited. Angra Do Heroismo, off which we anchored, was at one time, prior to 1832, the capital of the Archipelago

and is nearly 100 miles distant from Ponta Delgada, which succeeded Angra as the capital town and principal port. It was here on the 2nd of June 1963 that we met, and spent some time with, a naturalist of wide repute, Colonel J. Agostinho, whose knowledge of the zoology and geology of the islands is second to none in the Archipelago. To his credit was the first discovery of Bulwer's petrel, *Bulweria bulwerii*, breeding in the Archipelago, as recorded in « *Alauda* » 1937, and of the visit to several of the islands in the winter of 1963 of a party of Mute Swans *Cygnus olor*, two of which fell to gunners in Terceira and were duly preserved. The first occasion on which any Swan had ever been reported from the Azores Archipelago, Colonel Agostinho reported them from the first as mute swans, but a female specimen, now in the Museum at Ponta Delgada, gave some reason to doubt the identity, and not until photographs of the specimen had been sent to the Smithsonian Institution in Washington, where they were expertly examined by Doctors Alexander Wetmore and John Aldrich, was the identification *C. olor* confirmed. Female swans are extremely difficult to identify and the possibility of an American species being involved — as first suggested by Senhor Alvares Cabral — could not be excluded.

Terceira in the not so distant past had the ornithological advantage over the other islands in the central group of possessing a good sized marsh in which the Moorhen and other marsh loving birds were wont to congregate and breed. The moorhen of Terceira has been described as an insular race but its haunts in the island have now been drained and we learned from Colonel Agostinho that it is now seldom seen, though not yet extinct, for a young bird has recently been brought to him. The Coot is another bird whose numbers are dwindling as a resident, but which can look for reinforcements from overseas in the winter months, and it was to this marshland that Little Bitterns from Europe occasionally made their appearance. There had been a small incursion of this species to the Azores a month before our visit and one or two had even reached Madeira where we chanced to examine specimens which had been brought to the Museum. It was during our first visit to Angra that Colonel Agostinho suggested the possibility from its behaviour — as witnessed by himself in Terceira — and from information received from

a correspondent in Graciosa in whom he placed confidence, that the Turnstone *Arenaria interpres* occasionally bred in the Archipelago, for news had reached him of a parent supposedly of this species having been seen between Vitoria and the lighthouse on Ponta da Barca « leading its young on the shore to a safe retreat ». As in the course of my long experience in the British Museum and elsewhere I had received similar assurances from other areas in which northern breeding species were said to have been discovered breeding far beyond their known range, but which, on further examination, were perforce refuted, I dismissed these breeding records as too unlikely to be possible, feeling some error of identification must have occurred. Great was my astonishment on returning to the Azores in 1964 to be met on the ship by our good friend Sr. Cabral, the honorary director of the Museum Carlos Machado, with a photograph of a chick of a shore bird taken by a German investigator in the month of June 1964, purporting to be that of *Arenaria interpres* ! I confess that I was almost convinced but not quite There was something wrong, the tarsus too long, the eye too large. The markings did not quite agree with those of Turnstone chicks in the Royal Scottish Museum and British Museum, photographs of which I had taken the precaution to bring out with me to the Azores Scottish caution prompted me to send that photograph to a friend in Britain, who submitted it to the expert opinion of ornithologists on the staff of our two leading Museums. With skins of the chicks of wading birds before them for comparison, the verdict was reached unanimously that the chick captured but not preserved on Terceira on the 29th July 1961 at Praia was that of the Kentish plover, *Charadrius alexandrinus*. That opinion has now been endorsed by two well-known naturalists who are familiar with the Turnstone chick in Norway Thus was exploded yet another myth — just in time ! Photographs of birds, unless very exceptional, are a dangerous means by which to make certain identification. It is a lesson which should be taken to heart in this age, when the collecting and preserving of specimens in the aid of scientific research is looked upon as reprehensible Identification by means of photography alone is *bound* to lead to errors.

Our next port of call was Graciosa and as we neared the island we were delighted to see in our wake the first Stormy

petrels — almost certainly *Oceanodroma castro*, which we had met with on this voyage. We had already made history by identifying an Arctic Skua, *Stercorarius parasiticus*, some five miles out from Angra, believed to be recorded from the Azores for the first time, and had passed close to some high larva cliffs on the *ledges* of which Common Terns, *Sterna hirundo*, were unquestionably breeding, the first time we have ever seen this tern nesting in such a situation, although we have heard of it doing so in the Desertas off Madeira. As the CARVALHO passed, the terns, for some reason, panicked and, accompanied by hundreds of Rock-pigeons, *Columba livia atlantis*, poured from the ledges, transforming the dark cliff face into a whirling mass of white and blue — a very lovely sight.

It was not until 3 p. m. that our ship dropped anchor off the little port of Praia, and as it was pouring with rain and we lay far from the landing place, we elected to remain on board. Our time was not wasted, however. Lying off shore was a low-lying island from which a continuous stream of terns were making their way to fish in a shallow bay, upon the shores of which tiny waves were breaking. As the birds passed to and fro we observed that on their return journey their bills were filled with little silvery fish, a sure sign that they were feeding young. Closer inspection revealed that all but a very few were Roseate Terns, *Sterna dougallii*, making for the low sandy spits which jutted out to sea at either end of the island. There must have been hundreds of them — the largest roseate colony which either my wife or I had ever seen ; bird after bird passed close to our ship, allowing an unrivalled view of their bills, the greater part of which were black, and of the exceptionally long streamers in the tail ; we were to meet with other roseate colonies again in Faial, where they were in the minority, but on this islet off Graciosa the roseates held complete sway. When we realised how seldom they had figured in the Azorean literature — Godman had recognised a few amongst a common tern colony off Faial in 1865, and José Correia had collected a specimen in 1927 — we were all the more astonished by the numbers we encountered. If, as seems improbable, they can remain unmolested by local egg thieves, it will be one of the largest breeding places of this tern in the Western Atlantic. Roseate terns are proverbially fickle however, here today and gone tomorrow,

for very little disturbance will cause them to leave their breeding place, as we know to our cost in the British Isles

From Graciosa our voyage took us to São Jorge where we anchored after dark under the shadow of tremendous cliffs to land passengers and leave again before dawn. Daylight found us lying off a tiny port named Prainha on the north coast of Pico, where we were fortunate to find a car in which we traversed nearly the whole of the island before taking a fast launch at Madalena in which to cross the dividing strait to Horta, the capital of Faial.

Pico is a delightful island well covered with trees, the rich larva soil planted with crops and vines. The roads were bordered with white and yellow daisies (a refreshing change from the ubiquitous hydrangeas), the brilliant pink of the ice-plant (*Mesembryanthemum*), and many coloured geraniums. The « Pico » itself rises steeply to 2510 metres (7613 feet) and is often covered in cloud. Great larva flows run from its cone to the sea and forest covers the lower slopes of the mountain, the former haunt of the Azorian wood pigeon (*Columba palumbus azorica*), which is now a scarce bird everywhere. All the commoner birds were seen on Pico but the pigeon — if it still exists — remained hidden in the woods where it was so numerous in days gone by.

Of our experiences in Faial we have no space to write — the island interested us much less than the next two to be visited : Corvo and Flores, lying farthest out in the Atlantic, isolated by more than 100 miles of sea from Faial and Graciosa, and 680 miles east of the Grand Newfoundland Banks and the nearest American land — these outposts in the Ocean are to my mind the most romantic of all the islands we had visited. In Corvo, upon whose treacherous rock-girt shore we landed on the 5th June 1963, one might have stepped back 100 years, so primitive did life appear to be. In Corvo and Flores, the latter rightly famed for the beauty of its scenery and the luxuriant vegetation it supports, much of it, alas, introduced from warmer climes, we have the two islands first to be sighted by American vagrant birds, of which there is now such an imposing list. Corvo is said to be the only island in the Archipelago upon which the Manx Shearwater (*Puffinus puffinus*) breeds, but that can be disputed. It is the smallest island of the group, 4 miles ½ by 3 miles, with its population of under 1000 gathered into the only township,

Rosario, with its highly precarious landing place amongst jagged and terrifying rocks sticking up at every angle Our landing there was something to be remembered and only possible on what the islanders and probably no one else term a calm day.

Flores « where Sir Richard Grenville lay » is only a short distance from Corvo and as we neared the island rafts of Cory's Shearwater (*Puffinus diomedea borealis*) the « Cagarra » of the Portuguese were seen floating on the sea, hundreds of birds in every « raft ». A line of huge lighters filled with large black and white cattle, drawn by a small launch, came out to meet the CARVALHO, for there is a regular trade of these draught animals between Flores and Lisbon. The work of hauling them aboard from the tossing lighters was a sight we shall not lightly forget. The boatmen of Corvo and Flores are renowned for their prowess ; they must be second to none in the world for the skill with which they manage their boats in turbulent seas.

Flores impressed us tremendously. A drive half way round the island by a road cut out of the cliffs before turning inland and climbing to the central moorlands enabled us to obtain a good idea of its varied scenery and bird life. The high ground on this island reminded us of a Scottish moorland and we could well imagine that Teal, Mallard, and Snipe would bring up a family in such favourable surroundings if permitted to do so. From one point it is possible to leave the road and look down upon a beautiful crater lake upon which two terns were fishing Fine as is the inland scenery of Flores, that of the coast is grander still. The coast line between Santa Cruz and Lajes das Flores is truly magnificent. Here, if anywhere, the dark Rock-pigeons which I named *atlantis* are able to breed true Land birds on these islands so far distant from their nearest neighbours some 150 miles have not, as one might expect, become differentiated from those in the central group of islands, but in Flores at least they were well represented by the usual ubiquitous species.

In this short essay I have attempted to give my impressions of the Azores as seen by a visiting naturalist with no special qualifications for the job other than my interest in Oceanic islands. The Azores are typical examples of such, always poor in the number of breeding birds and in this ins-

tance not in the course of any regular stream of migrants, as is for instance Cyprus or the Canary Islands. Even so, the Azores are remarkable for the number of migratory birds, wind blown or sea-borne vagrants, which have reached their shores. One hundred and twenty-five species have already been recorded in this category. While the great majority are of European origin, no less than twenty-one of the vagrants hail from North America, representatives of the Families *Fregatidae, Podicipitidae, Ardeidae, Alcedinidae, Cuculidae, Rallidae, Anatidae, Charadriidae*, and *Turdidae*, the last named contributing the only American Passerine species to have crossed the 2000 miles to reach São Miguel. The American influence has never been sufficiently stressed but it was mentioned by Staffan Ulfstrand in his interesting observations « On the Vertebrate Fauna of the Azores » (*Bol. Do Museu Municipal Do Funchal*, XIV, 1961, pp 75-86) quoting only 10 species of American origin known to Mayaud and De Chavigny in 1932. Since then the list has been more than doubled. Ulfstrand points in his short review to the north-central European character of the Azores avifauna rather than to a south European, caused he believes by the stronger migratory tendencies of the northwest European populations.

One species of Arctic affinities must receive special mention : the Snow Bunting (*Plectrophenax nivalis*). It may now be reckoned a regular passage migrant to the Archipelago. It has visited the islands in small numbers since the days when F. Du Cane Godman reported it from Corvo in 1864 65, to which island Senhor Fernando Rocha, Chef du Service Météorologique, now considers it an annual visitor in winter. We have seen it ourselves at sea off Flores when travelling on a ship in April bound from Chile to England via Panama and Curaçao.

Another link with Greenland is furnished by the arrival at intervals of the Greenland Wheatear, *Oe. oe leucorrhoa* ; of the seven specimens in the Carlos Machado Museum at Ponta Delgada of *Oenanthe oenanthe*, every one proved by its measurements to belong to the Greenland race No example of the typical subspecies is in the collection. In Madeira, on the other hand, the only Wheatear collected on the main island is *Oe. oe. oenanthe*. On Porto Santo specimens of *Oe. oe. leucorrhoa* have been obtained. I have examined and

measured all these birds. We are still at a loss to account for Godman's extraordinary statement (*Natural History of the Azores*, p. 25) that he found « four or five pairs (of *Oe. oenanthe*) in the old crater on Corvo which had bred there, as I saw young birds that could scarcely fly ». That visit of two days duration took place about the second week of May 1865, he did not collect a specimen on Corvo.

As earlier remarked in this essay, the number of land and fresh water birds known to breed or to have bred in the Archipelago is strikingly small, for they have nine islands from which to choose, covering a huge area of sea. True land birds do not exceed twenty species in all which are known to breed regularly. This number can be raised to thirty five if we include the summer visitors, the sea birds and the petrel family (*Procellariidae*) which come to these islands to breed, the ducks (only two), and marsh birds which breed only exceptionally under favourable conditions and are invariably harried by man.

Of the resident species at least three have been introduced — the Partridge, the Goldfinch, and the Greenfinch, and now of all birds the Common sparrow, *Passer domesticus* ! Strange indeed is the absence of all Birds of Prey (*Falconidae*) except for the Buzzard, all Warblers (*Sylviidae*) except for the Blackcap, all Swallows (*Hirundinidae*) and all Swifts (*Apodidae*). There are no Woodpeckers and only one resident Owl ! We believe that we saw an unrecorded bat, considerably larger than *Nyctalus azoreum*, the only known species.

I have already over-run the length allowed me for this essay, for which I must beg forgiveness. Likewise, I must crave the indulgence of those who may read these notes, and especially my old and valued friend Jacques Berlioz, in whose honour his friends are contributing to this number of *L'Ois. et la R. F. O.* for I am well aware these scattered observations are not worthy of so important an occasion. They have, however, been written under some difficulty in Madeira immediately on our return from the Azores with impressions still fresh upon me.

May I end by expressing the hope that our honoured friend and colleague, Professor Berlioz, may have many happy years in which to enjoy his retirement and pursue his travels. He carries with him, wherever his steps may take him, the warmest regards and sincere good wishes of his

many friends, not least in admiration, the writer of these notes.

RESUME

Relation ornithologique d'un voyage effectué en mai-juin 1963 aux Açores. Voyage au cours duquel toutes les îles de l'Archipel ont été visitées, à l'exception de Graciosa et de Sao Jorge restées inaccessibles, l'état de la mer et l'absence de port interdisant tout débarquement. Malgré d'actives recherches, l'auteur est obligé d'avouer qu'il lui fut impossible d'observer les deux espèces qu'il avait placé en tête de liste : le Ramier des Açores, *Columba palumbus azorica*, et le Bouvreuil des Açores, *Pyrrhula murina*. La première semble de plus en plus rare, quant à la seconde, il faut craindre, d'après les informations recueillies, que l'on doive désormais la classer parmi les espèces éteintes ou bien près de l'être.

L'auteur redresse une erreur d'identification qui avait laissé supposer dans un récent passé que le Tournepierre, *Arenaria interpres*, aurait niché aux Açores. L'invraisemblance de l'information l'incita à vérifier les faits de plus près. Prudence justifiée, car il s'avère que l'oiseau signalé comme entouré de ses jeunes n'était qu'un Pluvier de Kent *Charadrius alexandrinus*. Par ailleurs le Dr BANNERMAN signale une importante colonie de Sternes de Dougall, *Sterna dougalli*, à Graciosa, et précise que 4 espèces ont été introduites : la Perdrix rouge, le Chardonneret, le Verdier et malheureusement le Moineau domestique.

Pour conclure, l'auteur souligne la rareté des Rapaces (à l'exception de la Buse), des Sylviidés (sauf la Fauvette à tête noire, *Sylvia atricapilla*) et, chose curieuse, des Hirondelles et des Martinets.

AN ANALYSIS OF BIRD CASUALTIES ON THE ROADS IN THE SOUTH WESTERN CAPE PROVINCE, SOUTH AFRICA

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Introduction

Information on bird road casualties in Britain has been published by Finnis (1956, 1960), and Hodson (1959, 1960, 1962); in France by Finnis (1959, 1960), in Holland by Mörzer Bruijns (1959); in Germany by Beckmann (1961), Held (1961) and Mariens (1962); in America by White (1926, 1927), Linsdale (1929), Robertson (1930), Barnes (1936) and Schorger (1954).

No information on bird casualties on South African roads has been published.

Since the last war, roads in South Africa have undergone a remarkable development and many of the main roads are now tarred. This has resulted in increase of traffic and also in speed.

From April 1960 until the end of March 1962 I gathered information on bird casualties on the roads in the South Western Cape Province roughly within a radius of 250 miles from Cape Town. During this time any mileage I covered in my car during the daytime was noted and any bird casualties encountered were recorded. In addition to my own observations others were received from a number of members of the Cape Bird Club (S. W. Cape Branch of the S. A. Ornithological Society). I am very much endebted to these contributors of which the following should especially be mentioned: Dr. J. M. Winterbottom, Messrs. R. K. Schmidt, B. M. Mackenzie, J. Martin, J. G. R. MacLeod, J. H. Hofmeyr, G. D. Underhill, Mesdames M. K. Rowan and I. Taylor and Misses E. B. Robinson, J. Robinson and C. St. C. Robinson.

The combined observations over both years cover a total of 41500 miles.

Results

1) Number of birds and number of species killed

All the recorded casualties have been tabulated in Table 1, where they have been broken down into species and different months of the year. In addition the number of miles for each month has been indicated.

The table shows that during the two years concerned as many as 72 species of birds were recorded as road casualties. A number could not be identified (a) because they had been dead for a considerable time and were flattened beyond recognition by traffic, or (b) because due to circumstances they could not be closely examined nor collected for future examination. During the total period of observation of two years and a recorded mileage of just over 41500 miles, 584 bird road casualties were recorded.

2) Comparison between the breeding-season and the non-breeding-season

The breeding season in the South Western Cape Province is from August to January and the non breeding-season from February to July. There are of course certain exceptions such as the Sugarbird (*Promerops cafer* (L.)) and the Orange breasted Sunbird (*Anthobaphes violacea* (L.) which are both chiefly winter breeders. The Cape Thrush (*Turdus olivaceus* L.) has a secondary breeding peak in the autumn and quite a number of species of duck nest in July. These few will, however, not effect the general picture.

Differences in road casualty rate between breeding- and non breeding season can be expected to occur. In Table 2 the the number of casualties and mileage covered has been separately tabulated for the breeding and the non-breeding-season.

In both years the number of casualties in the non-breeding season is considerably lower than in the breeding-season.

The number of miles covered differs for each of the two seasons in each of the different years. The difference for 1960-1961 is 5913 miles and for 1961-1962 it is 676 miles.

If the results for the two seasons are being compared the mileage should strictly speaking be about the same. If one assumes that the number of casualties is proportional to the distance covered one can calculate what the casualty figures theoritically should have been if the mileage covered in both seasons would have been the same.

TABLE 2

Number of casualties and mileage during the breeding season (August-January) and non-breeding-season (February-July)

Season	Number of casualties	Number of miles	Miles per casualty
1960-1961			
April-July 1960 ; February, March 1961	74	7620	103
August-December 1960 ; January 1961	243	13533	55.7
1961 1962			
April-July 1961 ; February, March 1962	76	9839	129.5
August December 1961 ; January 1962	192	10515	54.8

If this adjustment is made the following figures are obtained : 1960 1961 Non-breeding season 133, Breeding-season 243 casualties. 1961 1962 : Non breeding season 84, Breeding-season 192 casualties.

It seems, therefore, that in each of the two years bird casualty figures during the breeding season were about twice as high as during the non-breeding-season.

3) *Species most frequently killed*

From Table 1 the total number of casualties of any one of the 72 identified species for each of the two years and for the total two year period can be calculated. The eight most frequently killed species are tabulated in Table 3 and pictured in Plates I and II.

From this table it can be seen that the order based on frequency differed somewhat for each of the two years. During the period 1960-1961 the Bokmakierie headed the list of casualties closely followed by the Cape Sparrow and then the sequence was Laughing Dove, Fiscal Shrike, Turtle Dove, Cape Canary, Cape Weaver and Spotted Eagle Owl. For the period 1961 1962 the Cape Sparrow headed the list, closely

followed by the Cape Weaver and the others followed in the sequence Fiscal Shrike and Cape Canary, Cape Turtle Dove, Bokmakierie, Laughing Dove, Spotted Eagle Owl.

TABLE 3

Species which were most frequently killed

Species	Number of casualties		Percentage of total number of casualties
	1960-1961	1961-1962	1960-1962
Cape Sparrow	28	30	10.9
Bokmakierie	30	13	8.1
Cape Weaver	12	27	7.3
Fiscal Shrike	18	20	7.1
Cape Turtle Dove	17	18	6.6
Cape Canary	14	20	6.4
Laughing Dove	20	12	6.0
Spotted Eagle Owl	12	8	3.7

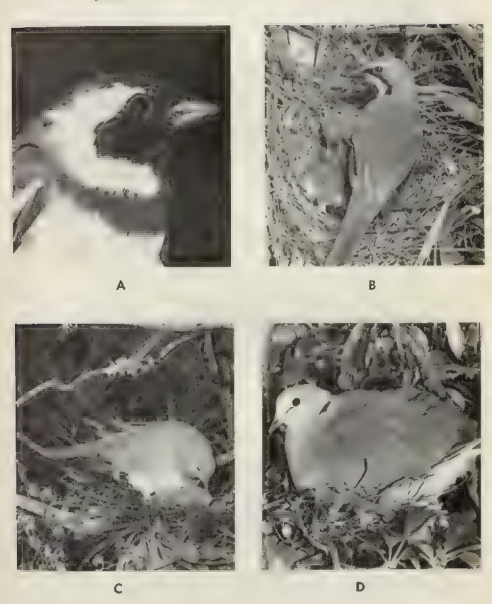
Although the sequence within the first eight species differed in the different years, the same eight headed the list of casualties in each of the two years. The sequence in Table 3 is based on the two years combined.

Discussion

The number of bird road casualties recorded during the investigation no doubt only represents a part of the actual number. Badly squashed birds, especially when rather smallish or having been killed a long time ago are easily overlooked by the observer travelling in a car at a speed between 50 to 60 miles an hour. Moreover a considerable number of birds hit by a car will be thrown right off the road especially when hit by a fast travelling car. These will, therefore, not be noticed by an observer passing later.

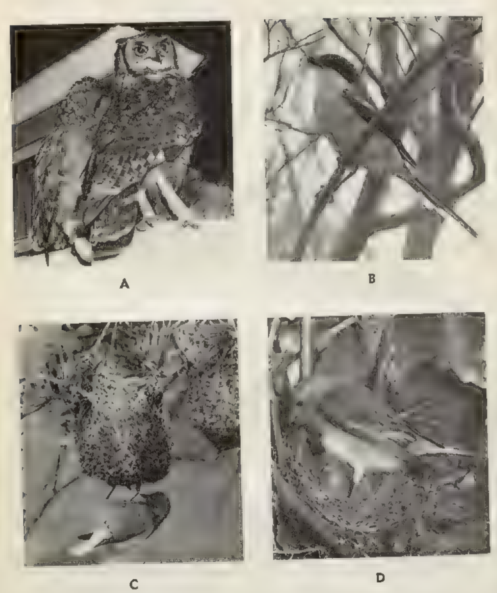
As has been shown the overall total casualty rate works out at 584 birds on just over 41500 miles. This is one bird to every 71 miles.

It seems reasonable to assume that my own observations where the more accurate ones as during the two years period the investigation lasted I was always concentrating on spotting bird road casualties. If my records are separated from



A. Cape Sparrow, *Passer melanurus* ♂ ; B. Bokmakierie, *Telephorus zeylonus* ; C. Laughing Dove, *Streptopelia senegalensis* ; D. Cape Turtle Dove, *Streptopelia capensis*.

(*Photographies G. J. Broekhuysen*)



A. Spotted Eagle Owl, *Bubo africanus*; B. Fiscal Shrike, *Lanius collaris*; C. Cape Weaver, *Ploceus capensis* ♂; D. Cape Canary, *Serinus canicollis*.

(Photographies G. J. Broekhuysen)

the rest, it appears that during the first year I covered 8468 miles with a casualty rate of one bird per 48.1 miles. During the second year 10676 miles were covered and the casualty rate was one bird per 63.9 miles. If the two years are combined the casualty rate works out at one bird per 55.8 miles. This is a higher casualty rate than the one obtained from the data tabulated in Table 1.

Finnis (1960) summarises information on bird road casualties in Britain, France and America. He does not mention results obtained by J. McB. Robertson (1930) for California which work out at 63.9 miles per bird. Mörzer Bruijns (1959) gives figures for Holland.

The casualty rates expressed in number of miles per birds for the different countries are as follows :

Britain	France	America	Holland
1.5	142.5	9.8	9.9
4.3	563	63.9	
6.3		1250	
6.7		2444	
12.5			
16.6			
42.7			
61.2			

In the case of the figures for Britain, in five instances the observer cycled, in two he walked and in one he was in a moving car. In all cases for France and America the observer was in a moving car while the figure for Holland was based on observations from a bicycle. Reinhold Held (1961) gives bird road casualties over a wide area in Germany but he does not give the actual casualty rate. From his data the casualty rate can only be assessed approximately. The figure works out at about 347 miles. Beckmann (1961) counted the number of casualties along the same eight miles stretch every day for almost four years This was also in Germany. He does not give the exact mileage covered during that time, but it can approximately be worked out and one then comes to a figure of one bird per c. 1220 miles. Both Held and Beckmann observed from a car.

The results obtained for the South Western Cape Province (one bird per 55.8-71 miles) is closest to the figures for Holland and Britain.

It is clear that the number of birds killed in the South

Western Cape is much higher during the breeding-season than in the off-season.

Reasons for the high casualty rate in the breeding-season are — (a) the presence of juvenile and immature and, therefore, inexperienced birds, (b) birds collecting building material for their nests and which due the activated building urge become less cautious, (c) birds collecting food for their chicks in the nest and probably paying less attention to traffic while collecting food on and near the road and while crossing the road on their way to the nest, (d) activated courtship and aggressive behaviour which gives rise to chasing behaviour, etc.

The type of bird found as a casualty on the road varied tremendously, the two extremes being the Blue Crane on the one and the small Lesser Double-collared Sunbird, Crombek and White-eye on the other. The total number of 72 species identified seems rather high. If we total all the species mentioned by FINNIS (1956, 1960, and HODSON (1960, 1962), for British roads we come to 45. However, the avifauna of South Africa is considerably richer than that of Britain.

There are different ways in which a bird can become a casualty and during the present investigation some of these ways became quite obvious. One would expect species which feed from the surface of the roads to become frequent casualties and FINNIS (1956) mentions that members of the crow family are killed on the roads while feeding upon road casualties. The three members of the crow family in the Cape Province have the same habit and must be responsible for the removal of a considerable number of corpses of animals killed by traffic on the roads, but very few of them get run over themselves. In fact the only crow casualty among the 585 casualties was one Pied Crow. It is true that in this country crows are often shot at and are, therefore, extremely wary. Quite a number of birds of the lark and pipit families have the habit of sitting on the road, may be to dust-bath or because the road surface is warm. This probably accounts for the fairly high figure of 21 pipits and larks found dead on the roads.

Birds of the weaver and seed eater families are frequently seen on the road, feeding on droppings and in doing so may be run over by a speeding car. This is probably one of the reasons why the Cape Sparrow, Cape Weaver and Cape

Canary are among the eight species most frequently killed. This may to a certain extend also apply to the doves as the Cape Turtle Dove and the Laughing Dove are both fond of walking on the road, presumably while feeding but during the breeding period also while courting. The high casualty rate among the Spotted Eagle Owls is probably also due to feeding on the road during the night (*). The blinding effect of head lights of an oncoming car will no doubt be an additional lethal factor, in this case.

Low flying and running birds are often killed whilst crossing the road. Good examples are the Bokmakierie, Fiscal Shrike, Boubou Shrike, Cape Thrush and some warblers which always fly low and usually in a straight line over the road. Francolins, especially during the breeding season, often cross while leading their young from one side of the road to the other. If put to flight they move slowly and low over the ground. European Swallows often « hawk » low over tarred road surfaces and it is surprising that this species does not feature more promenently in the casualty figures. During a trip through the Eastern Cape Province in December 1961 I noticed many European Swallow casualties on the road.

Hesitation can be the cause of bird casualties. When crossing ahead of traffic, birds occasionally « jink » and take evasive action, sometimes even returning along their original course. Others fly off at a tangent but are overtaken and killed. In many cases these birds would have reached safety if they had continued along their original course or had flown up over the car.

Most of the recorded casualties were birds run over by other cars and only a small percentage concerns birds killed by the observer's car. It is usually only in the latter cases that the reaction of the bird towards the approaching car can be observed.

Reactions towards approaching car

Cape Sparrow one observation by Miss I. B. Robinson and three by G. J. Broekhuysen) :

(a) Several flew on the road towards the car, all except one swerved

(*) Hodson (1962) mentions the habit of owls of swooping towards a moving light, especially during the breeding season in some country districts of Britain. I have never noticed this habit among South African species of owls.

away just in time, but one dived right down in front of the car and was killed.

(b) One killed from a flock crossing the road in front of the car.

(c) One ♂ and one ♀ flew together crossing the road, they made no evasive movements and the ♂ was hit and killed. The car moved at c. 58 miles an hour.

(d) One bird while crossing the road, turned half way back when the car was noticed and escaped injury

Cape Francolin (two observations by R. K. Schmidt) :

(a) Young francolins crossing the road crouched, spread all over the road and were difficult to avoid. One was killed.

(b) Parent birds were trying to take their young across the road

Fiscal Shrike (two observations, one by G. J. Broekhuysen and one by R. K. Schmidt) :

(a) An immature bird being fed on the road remained on the road although the parent bird flew off. The young bird was killed.

(b) Bird flew up just in time and avoided collison with the car.

Cape Turtle Dove (two observations, one by B. M. Mackenzie and one by R. Russell) :

(a) Bird had been feeding in the gutter next to the road and was scared by passing car.

(b) Flew across the road and then noticing the approaching motorcycle turned towards the danger and actually hit the rider, but the bird was not hurt.

European Swallow (two observations by G. J. Broekhuysen)

(a) Bird was sitting on the road and did not get off in time. It was killed by a truck travelling at c. 45 miles an hour.

(b) Bird flew fairly low over the road towards the approaching car and hit the roof. The bird could not be found although it was seen to fall on the road.

Speckled Coly (one observation by R. K. Schmidt and one by Mrs. M. K. Rowan) :

(a) Bird crashed against windscreen of car travelling at 50-60 miles an hour. Bird showed no evasive action.

(b) Flock started to fly across the straight open road, but turned back when danger was noticed. One bird was hit as it was turning.

Bokmakierie (two observations by G. J. Broekhuysen) :

Twice a Bokmakierie crossed the road in front of the car in a straight low flight and showed no evasive action.

Cape Weaver (observation by R. K. Schmidt) :

Bird flew straight against the car and there was no evasive action. The car was travelling at 60 miles an hour and the weaver was thrown about two yards off the road.

Cape Thrush (observation by G. J. Broekhuysen) :

Bird crossed the road flying low and straight just in front of the car and just missing it. No evasive action.

Cape Robin (observation by R. K. Schmidt) :

Bird came out of the mist and was driven by a tailwind. When it noticed the car it showed evasive action but was hit at a speed of 25-30 miles an hour.

Cape Canary (observation by G. J. Broekhuysen) :

Bird flew straight down in front of the car. Feathers were flying but bird could not be found.

Cape Bunting (observation by C. J. Uys)

When the road crossing bird saw the car it took successful evasive action, but then all of a sudden flew back on its previous course and was struck down.

Orange-breasted Sunbird (observation by R. K. Schmidt) :

Bird crossed the road and took no evasive action and was struck down at a speed of 25-30 miles an hour.

APPENDIX

ALPHABETICAL LIST OF THE SPECIES IDENTIFIED AS ROAD CASUALTIES

African Quail	*Coturnix coturnix* (L.)
Bar-throated Apalis	*Apalis thoracica* (Shaw and Nodder)
Blue Crane	*Tetrapteryx paradisea* (Lichtenstein)
Bokmakierie	*Telephorus zeylonus* (L.)
Boubou Shrike	*Laniarius ferrugineus* (Gmelin)
Bully Seed-eater	*Crithaga sulphurata* (L.)
Cape Bulbul	*Pycnonotus capensis* (L.)
Cape Bunting	*Fringillaria capensis* (L.)
Cape Canary	*Serinus canicollis* (Swainson)
Cape Dikkop	*Burrhinus capensis* (Lichtenstein)
Cape Francolin	*Francolinus capensis* (Gmelin)
Cape Longclaw	*Macromyx capensis* (L.)
Cape Robin	*Cossypha caffra* (L.)
Cape Sparrow	*Passer melanurus* (Müller)
Cape Thrush	*Turdus olivaceus* L.
Cape Turtle Dove	*Streptopelia capicola* (Sundevall)
Cape Wagtail	*Motacilla capensis* L.
Cape Weaver	*Ploceus capensis* (L.)
Cape White-eye	*Zosterops pallidus* Swainson
Cape Widow-Bird	*Coliuspasser capensis* (L.)
Cattle Egret	*Bubulcus ibis* (L.)
Chanting Goshawk	*Melierax musicus* (Daudin)
Common Tern	*Sterna hirundo* L.
Crombek	*Sylvietta rufescens* (Vieillot)
Crowned Cormorant	*Phalacrocorax coronatus* (Wahlberg)
Crowned Guineafowl	*Numida meleagris* (L.)
European Starling	*Sturnus vulgaris* L.
European Swallow	*Hirundo rustica* L.
Familiar Chat	*Cercomela familiaris* (Stephens)
Fiscal Flycatcher	*Sigelus silens* (Shaw)
Fiscal Shrike	*Lanius collaris* L.
Grassbird	*Sphenoeacus afer* (Gmelin)
Greater Honey-Guide	*Indicator indicator* (Sparmann)

TABLE 1. — Bird casualties recorded on roads in the South Western Cape Province during the period April 1960 - February 1962 and the mileage covered

Species	January		February		March		April		May		June		July		August		September		October		November		December	
	1961	1962	1961	1962	1961	1962	1960	1961	1960	1961	1960	1961	1960	1961	1960	1961	1960	1961	1960	1961	1960	1961	1960	1961
PHALACROCORACIDAE																								
Crowned Cormorant	1									1		1												
Reed Cormorant									[illegible]															
ARDEIDAE																								
Cattle Egret																							1	
Yellow-billed Egret					1																			
Egret sp	1																							
Night Heron																							1	
ANATIDAE																								
Duck sp.																			1					
AQUILIDAE																								
Steppe Buzzard																							2	
Chanting Goshawk					1																			
PHASIANIDAE																								
Cape Francolin							1						1		1		1	1	1					
Grey wing Francolin														1									1	
Red-wing Francolin			1																					
African Quail																1								
NUMIDIDAE																								
Crowned Guinea-Fowl																		1						
RALLIDAE																								
Moorhen																1								
GRUIDAE																								
Blue Crane														1										
CHARADRIIDAE																								
White-fronted Sandplover												1							1					
BURHINIDAE																								
Cappe Dikkop	3				1	1							1		1				1			1	3	
LARIDAE																								
Hartlaub's Gull													1	1										
Common Tern																					1			
COLUMBIDAE																								
Cape Turtle Dove	3	1		3			1	4	1			1			2	1	2				2	2		
Laughing Dove	1	1			2	1	1	1		1		2			3	1	2		3		1	2	1	2
Cape Turtle/Laughing Dove	1	3			1							1							2	2			1	2
BUBONIDAE																								
Spotted Eagle Owl					2	1	1		2			1		1	1		1	1	3		1		1	4
CAPRIMULGIDAE																								
S. A. Nightjar	1																							

Species	January		February		March		April		May		June	July		August		September		October		November		December	
	1961	1962	1961	1962	1961	1962	1960	1961	1960	1961	1961	1960	1961	1960	1961	1960	1961	1960	1961	1960	1961	1960	1961
COLIIDAE																							
Speckled Mousebird																		1					
White-backed Mousebird									1			1		1								1	
Red-faced Mousebird													1					1					
Mousebird sp.														1									
INDICATORIDAE																							
Greater Honey Guide																		1					
ALAUDIDAE																							
Thick-billed Lark	1															2	1					1	1
Karroo Lark																							1
Red-capped Lark			1		1									1		2							
Long-billed Lark																1							
Grey-backed Finch Lark																		1					
Lark sp.																1							
HIRUNDINIDAE																							
European Swallow	3			4	1																	1	3
Larger Striped Swallow																1							1
CORVIDAE																							
Pied Crow																		1					
PYCNONOTIDAE																							
Cape Bulbul						1		3								1	1		1	1	1		1
TURDIDAE																							
Cape Thrush	1					1					1		1	1		1	2	3		2			1
Mountain Chat																							
Familiar Chat	1																						1
Sickle-wing Chat																		1					
Stone Chat															1								
Cape Robin	1		1	1	1	1	1	2			1	1	1		1			1					
Karroo Scrub Robin																						1	
SYLVIIDAE																							
Crombek																						1	
Grassbird	1						1													1			
Bar-throated Apalis																							
Grey-backed Cisticola	2																					1	
PRINIIDAE																							
Karroo Prinia																						1	1
MUSCICAPIDAE																							
Fiscal Flycatcher	1																1						

Species	January		February		March		April		May		June		July		August		September		October		November		December	
	1961	1962	1961	1962	1961	1962	1960	1961	1960	1961	1960	1961	1960	1961	1960	1961	1960	1961	1960	1961	1960	1961	1960	1961
MOTACILLIDAE																								
Cape Wagtail						1								1	1		1							
Pipit sp.	1																							
Pipit or Lark																							1	
Cape Longclaw																	1							
LANIIDAE																								
Fiscal Shrike		2	1	1	1	3	1					1	1	1	2		3	1	3	1	1		5	
Boubou Shrike	1												1	1			1							
Bokmakierie	6	3	1	1	5		1	1	1	1		1		1	3	1	3	1	5	1	1		3	2
STURNIDAE																								
European Starling													1		2		1		1	2	3	1		
Wattled Starling																				1				1
Pied Starling			1				1										1	1	1	2		1		6
Red-winged Starling				1																				
PROMEROPIDAE																								
Sugarbird	2																1							
NECTARINIIDAE																								
Orange breasted Sunbird			1																					
Lesser Double-collared Sunbird																			1					
ZOSTEROPIDAE																								
Cape White-eye	2													1						1			1	
PLOCEIDAE																								
Cape Sparrow	1	1			3			2				1				2	2	2	9	1	4	2	4	18
Cape Weaver	2	2													1		1	1	5			1	3	22
Red Bishop Bird			1													1								
Cape Widow-bird	1		1		1												1	1	2					
Red/Cape Widow-bird			1														1							
FRINGILLIDAE																								
Cape Canary	3															3	3	9	5			1	3	5
Bully Seed-eater	1				1													1						
Yellow Canary																	3	2				1		
White-throated Seed-eater																1		1		2				
Seed-eater sp.	2		1		1																		1	
Cape Bunting					1																			
Unidentified	1	1	2		1	2	3	3						1		1	1	1	9	1	2		2	19
Month total in number	45	14	18	11	25	12	12	16	6			12	11	13	21	15	39	29	69	21	27	13	41	100
Number of different species	25	6	11	6	14	7	9	7	5			10	9	13	14	11	25	17	25	10	11	10	24	16
Monthly mileage	2629	1282	1264	947	2266	1031	1249	2038	779			1466	1541	2647	1376	2700	3172	2155	2214	1314	1846	1181	2296	1852

Source MNHN Paris

Grey-backed Cisticola	*Cisticola subruficapilla* (A. Smith)
Grey-backed Finch-Lark	*Eremopterix verticalis* (A. Smith)
Grey wing Francolin	*Francolinus africanus* Stephens
Hartlaub's Gull	*Larus hartlaubii* (Bruch)
Karroo Lark	*Certilauda albescens* (Lafresnaye)
Karroo Prinia	*Prinia maculosa* (Boddaert)
Karroo Scrub Robin	*Erythropygia coryphaeus* (Lesson)
Larger Striped Swallow	*Cecropsis cucullata* (Boddaert)
Laughing Dove	*Stigmatopelia senegalensis* (L.)
Lesser Double-collared Sunbird	*Cinnyris chalybeus* (L.)
Long-billed Lark	*Certhilauda curvirostris* (Hermann)
Moorhen	*Gallinula chloropus* (L.)
Mountain Chat	*Oenanthe monticola* Vieillot
Night Heron	*Nycticorax nycticorax* (L.)
Orange-breasted Sunbird	*Anthobaphes violacea* (L.)
Pied Crow	*Corvus albus* Müller
Pied Starling	*Spreo bicolor* (Gmelin)
Red Bishop Bird	*Euplectes orix* (L.)
Red capped Lark	*Tephrocorys cinerea* (Gmelin)
Red faced Mousebird	*Urocolius indicus* (Latham)
Redwing Francolin	*Francolinus levaillanti* (Valenciennes)
Red-winged Starling	*Onychognathus morio* (L.)
Reed Cormorant	*Phalacrocorax africanus* (Gmelin)
Sickle-wing Chat	*Cercomela sinuata* (Sundevall)
South African Nightjar	*Caprimulgus pectoralis* Cuvier
Speckled Mousebird	*Colius striatus* Gmelin
Spotted Eagle Owl	*Bubo africanus* (Temminck)
Steppe Buzzard	*Buteo buteo* (L.)
Stone Chat	*Saxicola torquata* (L.)
Sugarbird	*Promerops cafer* (L.)
Thick billed Lark	*Calendula magnirostris* (Stephens)
Wattled Starling	*Creatophora cinerea* (Menschen)
White-backed Mousebird	*Colius colius* (L.)
White-fronted Sandplover	*Charadrius marginatus* Vieillot
White-throated Seed-eater	*Crithagra albigularis* A. Smith
Yellow billed Egret	*Mesophoyx intermedius* (Wagler)
Yellow Canary	*Crithagra flaviventris* (Swainson)

RESUME

1) En deux années de recherches dans la partie Sud-Ouest de la Province du Cap (Afrique du Sud), l'auteur, après avoir parcouru 46500 milles (74700 km), a dénombré 584 oiseaux tués par accidents de la route.

2) 72 espèces furent identifiées.

3) Le taux d'accident pendant la période de reproduction s'avère à peu près le double de celui hors de la saison de nidification.

4) Le taux d'accident sur les routes de la zone étudiée est comparé aux données recueillies en Grande-Bretagne, France, Allemagne et Amérique.

5) Les différents modes possibles d'accidents sont étudiés ; quelques observations sur le comportement des oiseaux traversant la route devant un véhicule sont rapportées.

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LES PIGEONS DE LA NOUVELLE-CALEDONIE

par J. DELACOUR

Secrétaire général du IXe Congrès International d'Ornithologie (Rouen 1938)

Le goût des oiseaux et leur étude a eu tout d'abord, pour Jacques BERLIOZ, comme pour moi, une base esthétique Dès notre plus jeune âge, nous les avons aimés parce qu'ils sont beaux. Les aimant, nous avons voulu les connaître, et cela décida de nos carrières Bientôt nous avons dû envisager les problèmes nombreux qu'ils présentent, et les multiples aspects qu'ils revêtent. Cela fait peu à peu oublier le véritable point de départ.

La beauté des oiseaux est présente dans presque tous les différents ordres ; parmi tant d'autres, deux de ces derniers sont particulièrement attrayants par la singularité des caractères, par le nombre et variété des genres et des espèces dont le plumage, toujours élégant, est souvent même d'un éclat extraordinaire. Leurs formes, leurs mœurs très spéciales, attirent l'attention Je veux parler des Perroquets et des Pigeons, qui sont abondamment répandus dans toutes les parties du monde où le climat leur est favorable. Le plus grand nombre d'entre eux habitent les tropiques, mais on en trouve aussi dans des régions tempérées plus ou moins froides en hiver. Ces deux ordres d'oiseaux ont en outre l'avantage d'être représentés largement dans les îles, même celles de dimensions restreintes, particulièrement en Océanie, où des espèces somptueusement ornées existent un peu partout avec une exhubérance de variation vraiment étonnante.

J'ai eu l'occasion, au cours des trois dernières années, de visiter à deux reprises l'une des plus vastes et des plus riches, au point de vue de la faune avienne, des îles du Pacifique Méridional la Nouvelle Calédonie. J'ai pu y observer dans la nature la plupart des quelque 100 espèces qui l'habitent. J'ai aussi constaté avec beaucoup de satisfaction l'intérêt que portent à l'ornithologie un bon nombre de ses habitants , à tel point que je me suis décidé à publier à brève échéance

un manuel des oiseaux calédoniens qui permettra à ceux qui les rencontrent de les identifier et d'apprendre l'essentiel de ce qui les concerne.

Les espèces de Perroquets et de Pigeons y sont singulièrement nombreuses pour l'étendue du territoire. Il en existe quatre des premiers, et Jacques BERLIOZ en a publié une excellente étude (*L'Oiseau et la R. F. O.*, XV, N. S., 1945, p. 1). Quant aux seconds, je vais essayer de les évoquer ici.

La Région Calédonienne, composée de la Grande Terre, des îles voisines, et des trois Loyauté : Maré, Lifou et Ouvéa, ne possède pas moins de six espèces autochtones, auxquelles s'en est ajoutée une autre, introduite du sud est et de l'Asie : *Streptopelia trigrina*. Cette dernière s'est parfaitement acclimatée ; elle vit aux alentours des habitations humaines, dans les jardins et les cultures et, de ce fait, elle ne nuit aucunement aux espèces indigenes, qui ne fréquentent que les forêts ou les savanes boisées.

Des six espèces locales, l'une forme un genre séparé ; une seconde est endémique ; une troisième occupe aussi les Nouvelles Hébrides ; une quatrième est représentée par une sous espèce particulière, tandis que les deux autres appartiennent à des sous-espèces existant aussi, l'une dans l'ouest du Pacifique (des Salomons à Samoa), l'autre en Australie.

Quatre des pigeons calédoniens appartiennent au groupe des Carpophages, les Tréronines ; les deux autres à celui des Columbinés granivores.

Les affinités de ces espèces sont diverses. La première, *Ptilinopus greyi*, ne se rencontre ailleurs qu'aux Nouvelles-Hébrides, aux Iles Banks et Santa Cruz ; elle est voisine de *P. porphyraceus* qu'on trouve, sous plusieurs formes, à Samoa et aux Fijis. La seconde, *Drepanoptila holosericea*, est complètement distincte et ne paraît pas avoir de proches parents. La troisième, *Ducula pacifica*, vit aussi dans de nombreuses îles, depuis celles au large du nord est de la Nouvelle-Guinée, Ellice et Phoenix, jusqu'à Samoa, les Fijis et Tonga. La quatrième, *Ducula goliath*, l'énorme « Notou », est endémique, et ses seuls cousins, assez éloignés, sont *D. brenchleyi*, des Salomons, *D. bakeri*, des Nouvelles Hébrides, et *D. latrans*, des Fijis. La cinquième, *Columba vitiensis*, est une espèce largement répandue des Philippines et des Petites Iles de la Sonde à Samoa, sous des formes variées, et elle est apparentée à *C. janthina*, du Japon. Tous ces pigeons sont donc d'affi

nités nettement océaniques. La sixième, *Chalcophaps indica*, est sans doute d'origine australienne puisqu'elle est représentée en Nouvelle Calédonie par la sous espèce *chrysochlora* de ce continent. L'aire de dispersion de l'espèce comprend toute la région Indo-Malaise, de l'Inde aux Philippines, aux Moluques, à l'Ile Christmas, aux archipels d'Entrecasteaux et de Louisiade, et à la Nouvelle-Guinée, de la Baie de l'Astrolabe, au nord, au Hall Sound, au sud.

Voici la liste des pigeons de la Région Calédonienne

Ptilope de Grey
(*Ptilinopus greyi*)

Petit (20 cm). Couronne rouge violacé ; reste de la tête, cou, poitrine et côtés gris-vert clair ; manteau, ailes et queue verts, cette dernière avec bande terminale grise ; milieu du ventre rouge carmin ; sous-caudales orange ; œil brun ; bec gris-vert ; pattes rouges. La femelle est un peu plus terne. Les jeunes n'ont pas de rouge, et le dessous du corps est vert légèrement strié de jaune.

Cette jolie Colombe se nourrit surtout de petites figues de banyan et de baies. Elle est répandue dans les bois et les vergers, se déplaçant à la recherche de sa nourriture. Elle habite les Iles Loyauté, les Nouvelles Hebrides et îles voisines, mais elle est peu commune en Nouvelle Calédonie. Après les ouragans, on la trouve en grand nombre sur la grande terre, particulièrement dans le sud et à l'Ile de Pins, le vent violent l'ayant emportée des Loyauté. Elle diminue en nombre par la suite et, bien qu'elle niche, elle demeure rare jusqu'à ce qu'un nouveau contingent soit amené par une autre tempête.

Pigeon vert soyeux
(*Drepanoptila holosericea*)

Assez grand (mâle : 28 cm). Tête, cou, poitrine et parties supérieures vert brillant, avec une mince bande blanche du menton à la gorge, où elle se termine en pointe, et des bandes gris perle aux ailes et à la queue, qui est très ample ; les plumes du front et de l'avant de la couronne sont allongées et serrées formant une sorte de huppe touffue au-dessus du bec, qui est court et noir verdâtre ; une double barre étroite,

blanche et noire, au bas de la poitrine ; ventre jaune verdâtre ; bas-ventre et dessous de la queue jaune d'or, les sous-caudales aussi longues que les rectrices ; deux grosses touffes blanches sur les pattes, qui sont rouge carmin et presque cachées ; œil brun rouge. Les rémiges sont divisées à l'extrémité, les deux moitiés incurvées vers l'extérieur, caractère tout à fait unique. Femelle bien plus petite (23 cm) et plus terne, mais montrant, atténuées, toutes les marques du mâle ; les jeunes lui ressemblent de couleur.

Cette superbe espèce constitue un genre spécial, propre à la Nouvelle-Calédonie ; c'est sans doute le plus bel oiseau de la région, et, avec le Kagou, le plus intéressant et le plus particulier. Elle habite les forêts et les bois des savanes, et elle est souvent difficile à voir, car elle se tient immobile et se confond avec le feuillage, ne se signalant que par son fort et rauque roucoulement. Elle jouit en principe d'une protection totale, et il faut espérer que tous respecteront désormais ce joyau de l'avifaune calédonienne. Elle a malheureusement été décimée par une chasse abusive dans le passé.

Carpophage pacifique
(*Ducula pacifica pacifica*)

Grand (40 cm). Bec noir, faible, surmonté à la base d'une caroncule noire liserée de blanc, plus développée chez le mâle. Tête, cou et haut du dos gris clair ; dessous du corps gris vineux ; sous caudales marron ; dos, manteau, ailes et queue vert bleu, foncé et métallique ; pattes rouges. Femelle légèrement plus petite et plus terne.

Cette belle espèce se rencontre dans l'ouest du Pacifique. Elle est commune aux Loyauté, mais ne paraît visiter qu'irrégulièrement la Nouvelle Calédonie où, comme le Ptilope de Grey, elle est amenée périodiquement par les ouragans. Elle niche et s'établit, mais diminue en nombre assez rapidement. Se réunit en bandes, volant d'île en île à la recherche des fruits dont elle se nourrit. Roucoulement profond et rauque.

Carpophage goliath
(*Ducula goliath*)

Très grand (50 cm). Gris ardoisé noirâtre, avec du marron aux ailes, au ventre et à la queue, et du blanc aux parties

anales, œil orange, bec et pattes rouge carmin. Appelé localement Notou.

C'est l'un des oiseaux les plus particuliers et les plus intéressants de la Nouvelle-Calédonie, et aussi le plus gros de tous les Pigeons arboricoles du monde. Seuls les Gouras de la Nouvelle-Guinée, espèces terrestres, le dépassent en taille.

Ce splendide Carpophage fréquente les forêts, où on entend résonner sa voix tonnante et étrange. Il se nourrit de fruits Il a malheureusement été décimé par une chasse irraisonnée, et il est urgent de le protéger par des mesures efficaces, telles qu'une très courte saison d'ouverture, et surtout la création de réserves

Pigeon a gorge blanche

(*Columba vitiensis hypoenochroa*)

Grand (40 cm). Tête, cou, haut du dos et dessous du corps marron pourpré brillant, avec la gorge et les joues blanches ; reste du dessus du corps gris foncé avec de riches reflets verts sur le dos ; bec, paupières et pattes rouges. Jeunes plus ternes, avec la gorge grise.

C'est un véritable Pigeon, avec un bec plus dur que celui des espèces précédentes Il habite toute la Région Calédonienne Il se déplace dans les forêts et les savanes, souvent en troupes, à la recherche des baies et des graines, effectuant des voyages parfois considérables. Il niche assez bas, sur les pandanus, souvent même sur le sol, en particulier sur la grande terre.

Cette belle espèce est trop persécutée et diminue en nombre. Il est indispensable de réglementer plus sérieusement sa chasse et de la protéger.

Colombe Turvert

(*Chalcophaps indica chrysochlora*)

Assez petite (25 cm). Queue courte et pattes hautes Tête, cou, parties inférieures et manteau roux vineux, plus pâle en dessous ; ailes vert émeraude métallique avec une petite tache gris pâle à l'épaule et les rémiges brun foncé ; dos noir avec deux bandes grises ; queue brun foncé ; œil brun, bec orange ; pattes rouges.

Cette belle Colombe habite la Région Calédonienne, les Nouvelles-Hébrides et l'Australie ; d'autres sous-espèces, la plupart avec la couronne grise chez le mâle, occupent le sud de l'Asie, la Malaisie et les régions situées au sud-est.

C'est une espèce terrestre, qui se nourrit de graines tombées. Elle vit sous bois et dans les savanes, se cachant dans les arbres épais, et elle n'est pas facile à voir, bien qu'assez commune ; on la surprend parfois traversant au vol un sentier ou une clairière. Ce vol est rapide et direct, et elle se perche fréquemment. Niche sur les arbres bas.

QUELQUES PARTICULARITES DE LA REPRODUCTION DES OISEAUX DANS LES HAUTES ZONES DU THIAN CHAN

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Les renseignements recueillis dans les hautes montagnes de Thian Chan, au cours d'expéditions et d'excursions effectuées par L. STÉPANYAN pendant la saison de reproduction des années 1953, 1954, 1956, 1957, 1959, 1960, ont servi de base à cet article.

Les données indispensables pour la comparaison (nombre de pontes, quantité d'œufs pondus chez les populations de plaines de certaines espèces largement répandues) sont tirées de publications diverses, judicieusement condensées dans la Monographie « Les oiseaux de l'Union Soviétique ». En revanche, les données sur le taux de fécondité des oiseaux en haute montagne sont toutes originales, vu que dans les ouvrages spécialisés, à de rares exceptions près, l'altitude précise des lieux de nidification n'est pas indiquée, alors que ce fait présente une importance décisive lors de la comparaison de la fécondité des populations d'une même espèce en fonction de leur répartition verticale. Dans cet article, les étages subalpins et alpins ont été réunis sous le terme de « haute montagne » et se situent à une altitude de 2900 à 4000 m (et parfois même plus au-dessus du niveau de la mer.

L'écologie des populations d'une espèce donnée est à la base des problèmes touchant l'écologie de l'espèce dans son ensemble. Néanmoins, les méthodes actuelles de recherche ne permettent pas toujours de détecter ni d'éclaircir d'une façon satisfaisante les particularités de l'existence de l'espèce dans les différentes parties de sa zone de répartition. Il nous arrive souvent d'avoir affaire, pour une même espèce, à toute une série de formes géographiques morphologiquement bien caractérisées pour lesquelles les différences écologiques ne

sont pas toujours suffisamment nettes. Souvent les races d'une même espèce ne diffèrent que par des détails de biologie relativement insignifiants. Ainsi, elles ont par exemple des dates variables pour le début et la fin de certains cycles vitaux : reproduction, mue, etc...

De telles différences sont le plus souvent observées chez les espèces largement répandues, mais néanmoins, dans les limites de l'aire de répartition où les conditions écoclimatiques conservent leurs caractères principaux. Dans ces zones les parties optimales et minimales sont mal déterminées. Par ailleurs, lorsque l'espèce possède une haute plasticité écologique elle peuple des étendues dont les caractéristiques de certaines parties diffèrent sensiblement. Dans les limites de l'aire de distribution d'une telle espèce les zones les plus comme les moins favorables sont nettement exprimées. Les différences écologiques des formes géographiques de telles espèces eurytopes ont un caractère sensiblement plus profond. On observe chez elles, en plus des particularités phénologiques, des différences permanentes dans l'intensité et les rythmes de reproduction. Comme on le sait, la fécondité et la mortalité sont toujours en stricte corrélation entre elles et, dans les conditions normales, la majorité des espèces animales a, quantitativement, une limite d'oscillation relativement peu sensible. Cependant, comme l'ont démontré les résultats des recherches de certains auteurs, généralisés et analysés par D. LACK (1954), la fécondité est un phénomène par lui-même labile de l'organisme et varie largement selon les conditions, même chez un seul individu. Néanmoins elle a, dans tous les cas, un caractère excessivement adaptatif. Et, comme les recherches précitées l'ont démontré, le nombre d'œufs de la ponte correspond toujours aux possibilités d'élever la quantité maximum d'individus normaux de la jeune génération.

L'analyse de ce phénomène dans les milieux désertiques d'Asie Centrale (qui peuvent être considérées comme zones défavorables pour toute une série d'espèces) a été faite par A. K. ROUSTAMOV (1954).

Les hautes montagnes représentent, semble-t-il, une zone défavorable pour de nombreuses espèces largement répandues. Un des facteurs probables qui réduit le nombre de ces espèces paraît être la limitation des réserves de nourriture par les

conditions rigoureuses de ces lieux Cette dépendance se manifeste particulièrement chez les oiseaux insectivores. L'intensité de leur reproduction est ici nettement moins importante que dans les populations de plaines. Il est à noter que la majorité des espèces nidifiant en haute montagne n'ont habituellement qu'une ponte par an Sur les hautes montagnes aussi bien que dans d'autres parties de l'aire de répartition, des pontes de remplacement ont également lieu. Cependant, aux grandes altitudes, ce phénomène se rencontre plus rarement, vu la durée beaucoup plus brève de la saison de reproduction. *Eremophila alpestris albigula* Bp. est la seule espèce dont nous avons observé un cycle reproductif normal. Sur les hautes montagnes du Thian-Chan (3500 à 4000 m d'altitude), dans la deuxième quinzaine de juillet 1956, eut lieu la sortie en masse des petits de ces oiseaux. Des adultes se sont remis à pondre tout en continuant à nourrir leurs jeunes Toutefois nous constatâmes que ceci ne concernait pas tous les couples, car une partie d'entre eux se contenta d'une seule ponte Néanmoins, le fait que la répétition normale du cycle reproductif en haute montagne n'affecta qu'une partie de la population, mérite incontestablement notre attention

Pour comparer le nombre d'œufs dans la ponte des populations de plaine et de haute montagne, nous avons utilisé une série d'espèces largement répandues formant dans les montagnes des sous-espèces nettement caractérisées (voir tableau). Cependant, il est à noter que toutes les populations des sous-espèces montagnardes ne sont pas caractérisées par une fécondité plus basse. Ceci n'est vraisemblablement propre qu'aux groupes d'individus qui peuplent précisément les hautes montagnes mais non pas les montagnes en général. Dans ce cas, les limites écologiques et morphologiques de l'isomorphisme geographique peuvent ne pas correspondre entièrement.

Dans le tableau ci-dessous nous n'avons utilisé que les données concernant les nids trouves dans les limites des zones alpines et subalpines, à l'exception de *Motacilla citreola* Pall. et *M. flava* L., dont les nids ont été trouvés à une altitude de 2400 m.

Ainsi, d'après le tableau ci-dessous, malgré une certaine insuffisance des données, on observe facilement une tendance à la reduction du nombre d'œufs par ponte chez les popu

NOMBRE D'ŒUFS PAR PONTE

Espèces et sous-espèces	Nombre de nids examinés ou source de renseignement	Nombre d'œufs dans la ponte max.	min.	moy.
Phylloscopus inornatus inornatus	Renseignements puisés dans la littérature	6	5	5,[illegible]
Phylloscopus inornatus humei	9	6	3	4,4
Motacilla citreola werae et *Motacilla flava flava*	Renseignements puisés dans la littérature	6	1	5
Motacilla citreola calcarata et *Motacilla flava feldegg*	6	5	4	4,2
Anthus trivialis trivialis	Renseignements puisés dans la littérature	6	4	5
Anthus trivialis haringtoni	5	5	1	4,2
Phoenicurus phoenicurus	Renseignements puisés dans la littérature	7	6	6,5
Phoenicurus auroreus	Renseignements puisés dans la littérature	6	[illegible]	[illegible]
Phoenicurus coeruleocephalus (1)	2	5	4	4,5
Phoenicurus erythronotus	5 10 (renseignements puisés dans la littérature)	[illegible]	3	3,9
Phoenicurus erytrogaster	2 6 (renseignements puisés dans la littérature)	[illegible]	3	4,1

(1) La littérature donne pour la ponte de *Ph. coeruleocephalus* de 3 à 5, soit en moyenne 4 œufs.

lations de haute montagne des espèces largement répandues en comparaison de celles des plaines. Il serait très intéressant de faire sur ce plan une comparaison entre certaines espèces spécialisées de montagne et de plaine rapprochées entre elles du point de vue systématique. Nos données permettent d'effectuer une telle comparaison pour les espèces du genre *Phoenicurus*. Les données sur les espèces de montagne sont originales, celles concernant les espèces de plaine sont tirées de la littérature scientifique.

Ph. phoenicurus L. habite l'Europe et les parties centrales de l'Asie jusqu'au lac Baïkal et les monts Sayan Oriental, à l'est. A l'exception des populations méridionales, la plus grande partie de l'aire de répartition se situe dans les plaines.

Ph. auroreus Pall. habite les régions autour du lac Baïkal jusqu'aux monts Kentey en Mongolie. La plus grande partie de l'aire de répartition embrasse la Mandchourie orientale, la Corée, la Chine à partir des régions du nord-est jusqu'au Yunnan. L'oiseau se trouve de préférence dans les forêts de plaine, au pied des montagnes.

Ph. coeruleocephalus Vig. vit sur les montagnes de l'Asie centrale, de l'Afghanistan, du Béloutchistan, de l'Himalaya, à l'est jusqu'au Sikkim et au Boutan. Biotope : forêts de conifères de montagne.

Ph. erythronotus Ev. vit sur les monts de l'Asie centrale, à l'est jusqu'au Baïkal méridional, Khangaï, Tarbagataï. Biotope : les bois de montagne et les buissons ; en Asie centrale, la partie supérieure de la zone des forêts de conifères.

Ph. erythrogaster Güld. peuple le Caucase, les monts de l'Asie centrale, l'Altaï et les régions situées au nord du Baïkal. Partout cet oiseau de haute montagne est étroitement lié aux conditions alpines.

Les données ci-dessus mentionnées peuvent être complétées par certains renseignements concernant principalement le nombre de petits par couvée qui attestent une fécondité inférieure de la sous-espèce de *Parus atricapillus songarus* Sev. en comparaison avec *P. a. borealis* Sel. ; ainsi que des populations de haute montagne de *Turdus viscivorus bonapartei* Cab. comparée au *T. v. viscivorus* L. européen. D'après les données tirées des ouvrages spécialisés, le nombre d'œufs dans une ponte de *Luscinia calliope calliope* Pall. de

plaine est de 4 à 6 alors que chez l'espèce de haute montagne *L. pectoralis* Gould elle va de 3 à 5 œufs.

Enfin, il est intéressant sous ce rapport de faire une comparaison entre les espèces de haute montagne et de plaine, qui du point de vue écologique ont beaucoup de points communs, mais phylogénétiquement sont loin l'une de l'autre. Tels sont, à notre avis *Regulus regulus* L. et *Leptopoecile sophiae* Sev. Les dimensions absolues du corps, la nourriture, la nidification et dans une certaine mesure le biotope de ces espèces ont beaucoup de points communs. Une ponte normale de *R. regulus* en Europe se compose de 8 à 9 œufs. La ponte normale de *L. sophiae* dans la zone subalpine de Thian-Chan ne dépasse probablement pas 4 à 5 œufs.

On peut ainsi supposer que la tendance vers la réduction de la fécondité sur les hautes montagnes est propre à plusieurs espèces d'oiseaux. Il est hors de doute que lors des recherches ultérieures toute une série de telles espèces sera révélée. Il est indispensable de souligner une fois de plus que ce phénomène est principalement propre aux oiseaux insectivores.

Parmi les causes des faits examinés, le caractère des sources nutritives dans les hautes montagnes a une importance primordiale.

Il n'est pas exclu qu'un certain rôle puisse être joué ici par le type de la balance énergétique dans les conditions du climat rigoureux de haute montagne. Néanmoins, il faut particulièrement souligner combien les tentatives actuelles d'explication du phénomène examiné ont un caractère hypothétique, car cette question exige une étude spéciale et de plus amples données. En tout cas, les hautes montagnes du Thian-Chan central possèdent une faune entomologique beaucoup plus pauvre, quantitativement et qualitativement, que les zones situées plus bas. Cependant, durant la période de nidification, toutes les espèces et sous-espèces d'oiseaux de haute montagne ci-dessus mentionnées se nourrissent, elles-mêmes et leurs petits, d'insectes. Ceci est démontré par la dissection des organes digestifs et par l'observation directe.

Par exemple *Ph. erythrogaster*, qui se nourrit principalement de plantes, alimente, sur les plateaux, ses petits d'insectes et surtout de chenilles trouvées dans les herbes desséchées qui constituent la flore locale. Les araignées, largement répandues sur les hautes montagnes, jouent un grand

rôle dans la nourriture des insectivores de ces lieux, cependant elles ne suffisent pas à constituer complètement la base alimentaire de ces espèces et cette dernière reste évidemment plus pauvre que celle, par exemple, au pied des monts ou dans la partie inférieure de la zone forestière. Il est possible que l'insignifiante quantité générale de tous les oiseaux insectivores de haute montagne soit liée à ce facteur limitatif. L'action permanente de ce facteur a provoqué l'apparition de certains caractères adaptatifs dans l'écologie des espèces avec une spécialisation alimentaire correspondante. Une fécondité basse comme particularité des populations de haute montagne d'espèces largement répandues, semble donc un caractère nettement adaptatif et doit être envisagé comme l'effet physiologique des conditions d'existence.

En cela se concrétise également une des manifestations de l'isomorphisme géographique sous son aspect écologique.

SUR LE FAISAN DE HUME ET LE GENRE *CALOPHASIS*

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(Rouen 1938)

Le Faison de Hume fut découvert en 1881 dans le Manipur par HUME lui-même, mais il n'eut pas la possibilité de mener des recherches personnelles sur cette espèce.

En effet, le seul couple qu'il possédait lui avait été donné par des indigènes, desquels il avait appris que ces Faisans vivaient dans des forêts épaisses à une altitude oscillant entre 800 et 1500 m ; ils n'étaient ni fréquents, ni abondants, dans la région qui s'étend jusqu'à la Birmanie Nord Ouest.

HUME voulu dédier à sa femme cette espèce nouvelle, mais au lieu d'écrire, comme il eût été correct, *humei*, il féminisa son propre nom d'une façon discutable puis le mit au genitif, d'où : *humiae*.

D'après DELACOUR, peu d'exemplaires furent capturés, par la suite peu de résultats satisfaisants furent obtenus en ce qui concerne l'élevage en captivité, enfin aucune importation en Amérique ou en Europe n'eut lieu avant la publication de son grand ouvrage : « The Pheasants of the World » paru en 1951.

En février 1963, M. George MUNRO, de Calcutta, m'offrit des Faisans de cette espèce. J'acquis deux mâles et une femelle. Le deuxième mâle fut accouplé avec une femelle d'Elliot. En 1963 et en 1964 j'obtins des deux couples de nombreux jeunes très forts que j'ai élevés très facilement. Ils m'ont ainsi permis de faire un second croisement correspondant à la formule *humiae* × (*humiae* × *ellioti*).

NOTES DESCRIPTIVES SUR *Calophasis humiae* HUME

Je ne donnerai pas ici une description de l'espèce, mais je voudrais souligner les différences saillantes entre *C. humiae* et *C. ellioti*.

Le mâle de *humiae* est légèrement plus petit et plus agile que le mâle d'*ellioti*. Ils ont, tous les deux, la même voix et la même démarche. La queue de *humiae* est plus longue, elle atteint en effet 400-535 mm de long, tandis que celle de *ellioti* oscille entre 390 et 440 mm. La longueur totale moyenne est de 900 mm pour *humiae*, de 800 mm pour *ellioti*, aussi la première espèce paraît-elle plus élégante et plus élancée que la seconde.

En ce qui concerne les couleurs du mâle, le caractère le plus frappant est la couleur du cou, entièrement métallique, changeant du vert à l'acier, aussi bien dans la région dorsale (brun blanchâtre chez *ellioti*) que sur les côtés blancs chez ce dernier. En outre chez *ellioti* les couleurs du cou se détachent très nettement des teintes rouge cuivre du dos et de la poitrine qui tranchent sur le blanc du ventre, tandis que chez *humiae* les nuances vertes passent graduellement au châtain foncé et brillant pour gagner toutes les parties inférieures.

Les parties supérieures, dos et ailes, sont châtain foncé chez *humiae* et rouge cuivre chez *ellioti*.

Le dessin général de l'aile est le même chez les deux espèces mais on peut remarquer des différences entre les trois bandes respectivement blanches et noires métalliques des ailes. La bande blanche des scapulaires est moins évidente chez *humiae*, tandis que celle qui traverse les couvertures alaires est plus large chez *humiae* que chez *ellioti*.

La tache elliptique placée au milieu de l'aile, noir luisant avec une légère nuance métallique chez *ellioti*, est plus ample et changeante (du vert à l'acier) chez *humiae*. Les dessins du croupion et de la queue sont différents chez les deux espèces : chez *ellioti* le dos et le croupion sont à bandes alternées blanches et noires, chez *humiae* les bandes blanches alternent avec des bandes bleu acier ; la queue de l'Elliot montre une alternance de larges bandes grises et de bandes châtain séparées les unes des autres par des bandes noires irrégulières ; sur la queue de *humiae*, de larges bandes grises sont alternées de bandes noires terminées par une mince bande brune.

La différence principale entre les femelles demeure dans la gorge, qui chez *humiae* est d'un gris pâle immaculé, tandis

que chez *ellioti* elle présente une tache noire en forme de bavette qui descend jusqu'à la base du cou.

Distribution géographique du genre *Calophasis*

Si l'on commence par l'Occident, on trouve *C. humiae* dans le Manipur et l'Assam, en contact avec *C. burmanicus* de la Birmanie dont la silhouette rappelle *C. ellioti* avec la tête et le cou de *C. humiae*. A une distance considérable on trouve en Chine orientale, au sud du Fleuve Yang-tsé Kiang, *C. ellioti* et au sud-est, dans l'Ile de Formose, *C. mikado*.

Hybridation

C. mikado fut découvert au début de ce siècle dans l'Ile de Formose, à 1500 m d'altitude environ. Au contraire de *Gennaeus swinhoei* (son compatriote, qui se reproduit très abondamment en captivité et vit dans les jardins de Tokyo à l'état semi-sauvage), *C. mikado* s'est révélé un mauvais reproducteur en captivité, notamment les femelles, lesquelles après avoir pondu pendant leur deuxième année de vie cessent toute activité reproductrice, ce qui n'est d'ailleurs pas un cas isolé. Quelles qu'en soient les causes, *C. mikado* est très rare dans les collections de Faisans vivants. Pour obvier à cet inconvénient, j'accouplai dès 1946 un *mikado* ♀ avec un *ellioti* ♂ et j'obtins des hybrides des deux sexes, pour lesquels les caractères *mikado* prévalaient sur les caractères *ellioti*, avec une telle intensité qu'on ne pouvait même pas imaginer que ces oiseaux avaient du sang d'*ellioti*.

D'autres éleveurs ont obtenu des résultats analogues en faisant un croisement inverse, c'est-à-dire un *mikado* ♂ et un *ellioti* ♀. Fait étonnant : ces hybrides ressemblent, plus que tout autre espèce pure ou hybride, à *humiae*, c'est à dire à l'espèce qui vit dans la région la plus éloignée de celle où vit *mikado*. Comme je l'ai déjà dit, *burmanicus*, voisin géographique de *humiae*, diffère de *ellioti* par la couleur de la tête et du cou, qui est plus ou moins celle de *humiae*.

C. burmanicus pourrait être considéré comme un hybride naturel *humiae* × *ellioti*, s'il n'existait une distance géographique énorme entre l'aire de distribution de ces deux espèces.

Le résultat du croisement *humiae* × *ellioti* est lui aussi étonnant. Chez ces hybrides les côtés du cou du mâle sont blancs, comme chez *ellioti* ; ce caractère est le plus remarquable, quoique les hybrides en question ressemblent beaucoup aux *ellioti*. Après un recroisement entre cet hybride et un mâle *humiae* pur, nous n'avons remarqué aucune différence saillante avec la race *humiae* pure. Les femelles aussi ne diffèrent pas des femelles *humiae* pures, tandis que les femelles hybrides du premier croisement présentent de petites taches noires à la base du cou vers la poitrine.

Si on compare *C. mikado* avec les autres espèces, j'ai noté les différences suivantes : des œufs considérablement plus grands et une période d'incubation plus longue de 24 heures ; la nomenclature qui considérait *mikado* comme un sous-genre *Cyanophasis* n'est pas justifiable.

Le genre *Calophasis*, selon nos connaissances biogéographiques, comprend les espèces précitées, bien définies géographiquement et non confluentes, sauf peut-être *C. humiae* et *C. burmanicus*.

Validité du genre *Calophasis*

Delacour et Beebe dans leurs ouvrages respectifs et Peters dans sa liste des oiseaux du monde, ne reconnaissent pas le genre *Calophasis*. En revanche celui-ci est accepté, entre autres par Ogilvie Grant et Oates qui groupent sous ce vocable en plus des Faisans à queue en échiquier (*Calophasis* proprement dit), le Faisan vénéré (*Syrmaticus reevesi*) et aussi le groupe des Faisans cuivrés japonais (*Graphophasianus*).

Si nous nous bornons à prendre en considération la morphologie de ces oiseaux, nous pouvons affirmer que la queue particulièrement longue du Faisan vénéré (*Syrmaticus reevesi*) et celle des Faisans cuivrés (*Copper Pheasants*) présentent des caractères différents.

Outre que *Syrmaticus reevesi* (♂ et ♀) n'a pas les caroncules des joues érectiles, ce qui le rend différent de toutes les autres espèces, sa queue extraordinairement longue chez le mâle l'est aussi chez les femelles. Enfin, comparées aux femelles des autres espèces, les rectrices sont pointues et non pas arrondies.

Les Faisans du genre *Graphophasianus* ont un nombre de rectrices qui oscille entre 18 et 20, tandis que les *S. reevesi* et les autres du groupe *ellioti* en ont seulement 16. Or le nombre des rectrices a toujours été considéré comme un bon caractère pour la distinction des genres. Mais il y a un fait qui met fin à toute discussion, c'est la « monogonarreie » que j'ai démontrée expérimentalement entre *Syrmaticus* et *Graphophasianus*. Des expériences que j'ai faites, il résulte que les femelles hybrides, obtenues en partant de ces deux espèces, ne sont pas fécondes (tandis que les mâles le sont). Enfin elles sont morphologiquement intersexuées car leurs queues ont une longueur intermédiaire entre celles des femelles et celles des mâles *reevesi*. *Graphophasianus* est donc un genre valable du point de vue physiologique et systématique, donc il doit être séparé du genre *Syrmaticus*.

Mes expériences d'hybridation entre *Syrmaticus* et *Graphophasianus* ont donné de faibles résultats. De deux couples différents *Graphophasianus* et *C. ellioti*, je n'ai obtenu que deux mâles seulement, qui ont eu une vie très brève, même si l'un d'eux avait atteint l'âge adulte et avait changé les caractères intermédiaires entre les mâles des deux espèces. Le croupion de cet exemplaire montrait beaucoup de blanc ce qui est un signe évident de l'hérédité paternelle, car le mâle de *Graphophasianus* était un *soemmeringi*.

De toute façon la difficulté que l'on éprouve à obtenir des croisements, la faible fécondité et la faible vitalité des exemplaires, m'ont fait conclure que l'affinité entre *Graphophasianus* et *Calophasis* est très médiocre.

Je n'ai pas fait d'expériences d'hybridation entre *Syrmaticus* et *Calophasis*, de toute façon mon expérience acquise après beaucoup d'hybridations me suggère que même les hybrides entre un Faisan vénéré (*Syrmaticus*) et un Faisan d'Elliot (*Calophasis*) doivent être monogonarréiques c'est à dire que seuls les mâles sont féconds, les femelles étant stériles et masculinisées.

J'ai fait un croisement entre ♂ *reevesi* et ♀ *ellioti*, et un autre encore entre ♂ *ellioti* et ♀ *reevesi* dont j'attends les résultats.

L'hybridisme donne des résultats étranges et imprévus, mais qui suivent de toute façon les règles de l'hérédité. Si par exemple certains caractères d'une espèce sont dominants par

rapport aux caractères correspondants de l'autre espece, du croisement d'un *Polyplectron chinquis* (*P. bicalcaratum*) avec une femelle de Faisan doré (*Chrysolophus pictus*), peut naître, comme j'ai pu le constater il y a quelques années, un Faisan qui juste après l'éclosion presente des caractères douteux propres au *Polyplectron chinquis*, mais qui par la suite devient un Faisan doré parfait.

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DE L'EFFET DESASTREUX DE L'ENROBAGE DES SEMENCES SUR L'AVIFAUNE SUEDOISE

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L'emploi de produits chimiques en agriculture et sylviculture soulève un des problèmes les plus graves que les Protecteurs d'Oiseaux aient jamais eu à confronter jusqu'à ce jour. Il y a deux points à distinguer : l'usage des insecticides et des herbicides d'une part, celui des semences enrobées d'autre part. Au cours de la dernière décennie, l'effet désastreux de l'enrobage des semences est devenu de plus en plus évident et c'est le moins qu'on puisse en dire ! En fait, dans plusieurs régions les espèces diminuent à une vitesse alarmante. Quoique les engrais chimiques aient été employés en Suède depuis des générations, c'est tout récemment que ces effets désastreux commencèrent à se manifester. Ceci est probablement dû à l'introduction de pesticides particulièrement virulents tels que aldrin, dieldrin, heptachlor, DDT, BHC et bien d'autres... ; mais il est dû aussi à l'usage excessif du mercure dans l'enrobage des semences. On signale qu'aux Iles Britanniques les pesticides organochlorés sont particulièrement nocifs. D'un autre côté il est reconnu qu'en Suède le mercure est responsable de catastrophes.

L'enrobage au mercure y est d'un usage courant et récemment il a été démontré que le dosage employé, quoique recommandé par l'Institut de Protection des Plantes agricoles, est beaucoup plus fort que nécessaire. En automne 1964 les rapports de cet Institut sur les effets des différents dosages révélèrent qu'un dosage à 50 % de celui communément employé obtenait les mêmes résultats. Il est déplorable que pendant des années des concentrations plus fortes que nécessaire aient été ainsi employées et il est probable que les

dosages pourraient être encore réduits sans perdre de leur effet. Signalons que bien des fermiers obtiennent de bonnes récoltes sans utiliser cette technique.

Au cours des dernières années de nombreux oiseaux ont été trouvés empoisonnés d'une façon ou d'une autre : morts ou paralysés. Comme dans quelques cas la présence du mercure fut décelée à la suite de l'analyse par l'Institut Vétérinaire de Stockholm, et comme d'autre part certaines espèces diminuaient en nombre d'une façon alarmante, la Société Ornithologique de Suède commença une enquête dès janvier 1964, notamment auprès de ses membres, afin de connaître les changements observés quant aux taux des populations et d'obtenir des informations sur les cas sûrement imputables aux pesticides. Les résultats furent publiés par G. OHLRLIND et I. LENNERSTEDT, dans la revue de cette société, *Vår Fågelvärld*, vol. 23, 1964, pp. 363-415, avec un résumé en anglais.

Les informations concernant les insecticides et les herbicides sont aussi alarmantes, mais les principaux dégâts paraissent être dus à l'enrobage des semences à base de mercure. Dans sa première manifestation l'empoisonnement rend l'oiseau beaucoup plus familier au point qu'il peut être plus facilement attrapé, ensuite les pattes sont paralysées et enfin l'oiseau meurt dans des convulsions.

On ne doit jamais perdre de vue qu'il peut y avoir, comme cause d'un déclin sérieux d'une espèce, d'autres facteurs que les pesticides. Une culture plus rationnelle peut considérablement changer l'accès aux lieux de nidification et d'alimentation pour beaucoup d'oiseaux. Le nombre décroissant des chevaux et des têtes de bétail peut également avoir son importance. En Suède, le déclin de l'Alouette lulu (*Lullula arborea*) peut être imputé à la mise sous forêt des petits champs entourés de bois, où elle préfère nicher. Mais, il ne peut y avoir aucun doute : l'énorme déclin numérique de quelques espèces est en relation avec l'emploi des pesticides dans les grandes régions agricoles, car dans les régions d'agriculture moins intensive comme dans les pays boisés ou dans les archipels les populations ont été moins affectées. Le Bruant jaune (*Emberiza citrinella*), le Bruant ortolan (*Emberiza hortulana*) et le Faucon crécerelle (*Falco tinnunculus*) ont pratiquement disparu des grandes régions de culture. On signale la disparition graduelle du Bruant jaune dans presque toutes les

régions de Suède. Un cas de patte paralysée a été observé et du mercure a été trouvé chez un spécimen. De semblables constatations ont été faites pour le Bruant ortolan ; dans un cas les oiseaux, sûrement paralysés par le poison, furent observés dans des champs où l'on avait utilisé des semences enrobées. La Crécerelle était communément aperçue survolant les champs des régions cultivées ; mais maintenant elle a totalement disparu. Pourtant elle n'a pas diminué dans les archipels. Des cas d'empoisonnement par mercure ont en revanche été confirmés.

Le Corbeau freux (*Corvus frugilegus*, a subi une diminution considérable. De nombreuses colonies ont disparu des régions agricoles et cette diminution est estimée environ à 75 %. Il n'est pas sûr que le Bruant proyer (*Emberiza calandra*) continue à se reproduire en Suède. De même le Moineau domestique (*Passer domesticus*) et le Moineau friquet (*Passer montanus*) ont considérablement diminué en beaucoup d'endroits. Ces deux oiseaux, facilement observés dans les cours des fermes, ont fait l'objet de nombreux rapports qui constatent la paralysie chez des individus nourris de semences enrobées, et signalent de multiples jeunes trouvés morts au nid.

D'autres rapports font état de Pigeons ramiers (*Columba palumbus*) paralysés ou morts, et ceci souvent en relation avec l'ingestion de semences enrobées. Des traces de mercure ont été trouvées au moins 3 fois dans les oiseaux morts. Presque tous les rapports sur la Perdrix grise (*Perdix perdix*) soulignent une importante régression de la population. Peut-être même peut-on dire que la population encore existante en Suède méridionale n'atteint guère plus de 10 à 50 % de ce qu'elle était il y a 10 ans. Souvent le poussin meurt dès son jeune âge. Pourtant en ce qui concerne la Perdrix, l'enrobage ne peut être accusé d'être le seul facteur dangereux. Il est évident que les herbicides et pesticides jouent aussi un rôle important mais l'analyse a trahi la présence de mercure dans plusieurs cas. Il en est de même pour nombre de Faisans trouvés morts, mais la régression de l'espèce n'est pas aussi certaine que pour la Perdrix Dans quelques endroits de nombreux Faisans ont été trouves morts ou manifestant des signes typiques d'empoisonnement. Dans une région où le printemps fut particulièrement sec, le blé enrobé demeura tel plusieurs semaines avant de pousser ; un déclin des Fai-

sans se fit alors sentir l'hiver suivant, en même temps que le nombre d'individus tués par les oiseaux de proie était particulièrement élevé.

Les oiseaux de proie, en tant que dernier échelon du cycle trophique, sont spécialement intéressants. Nous avons déjà signalé la disparition désastreuse de la Crécerelle ; le Faucon pélerin (*Falco peregrinus*) a lui aussi considérablement diminué, mais aucun cas d'empoisonnement n'a pu être vérifié. Les informations touchant la très petite population de Pygargue à queue blanche (*Haliaetus albicilla*) sont particulièrement alarmantes. L'un d'eux, vu les jambes paralysées, mourut le lendemain ; un autre trouvé mort révéla des traces de mercure dans le foie et les reins. Mais, ce qui est encore plus grave, plusieurs rapports ont constaté l'insuccès des couvées. Presque aucun jeune n'a pu être élevé, ils mouraient même avant que de pouvoir voler ; et dans beaucoup de cas, l'instinct de reproduction semble avoir été inhibé. Enfin un œuf d'un nid abandonné fut analysé et contenait 3,5 mg/kg de mercure.

De semblables constatations concernant des régressions de population, une réduction de la fréquence de reproduction et quelques cas dûment reconnus d'empoisonnement par le mercure ont été faites pour l'Autour des palombes (*Accipiter gentilis*), l'Epervier d'Europe (*Accipiter nisus*), et la Buse variable (*Buteo buteo*).

Enfin on signale encore des taux de reproduction particulièrement bas ainsi qu'une forte mortalité juvénile chez le Hibou grand-duc (*Bubo bubo*), le Hibou moyen-duc (*Asio otus*) et la Chouette hulotte (*Strix aluco*). En ce qui concerne cette dernière, deux jeunes furent trouvés morts 10 jours après l'ensemencement des champs environnants, ils ne contenaient pas moins de 270 mg/kg de mercure dans le foie et les reins.

Les faits ci-dessus ne donnent qu'une idée du matériel d'étude présenté par Otterlind et Lennerstedt, mais mon but était de souligner l'immense menace qui résulte pour beaucoup d'espèces d'oiseaux de l'emploi généralisé du mercure dans l'enrobage des semences en Suède. Mais ce n'est pas tout, le poison s'accumule dans le cycle trophique au niveau où interviennent les prédateurs et l'homme. Tout récemment un rapport préliminaire dont il fut fait état dans les journaux signale que l'Institut Vétérinaire de Suède (qui fait les

analyses) a trouvé chez les Faisans tués au cours de la saison de chasse jusqu'à *800 et 900 fois plus de mercure qu'il n'en était toléré dans la nourriture par l'Organisation Internationale de la Santé !* Nous avons donc atteint la limite au-delà de laquelle l'usage excessif des poisons va devenir un réel danger pour l'homme et cela malgré les cris d'alarme des protecteurs. Espérons que des faits aussi parlants ouvriront les yeux de ceux qui se refusent à voir le danger et les amèneront à une contre réaction dont bénéficieront également les oiseaux.

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De nouveaux faits survenus depuis la remise du manuscrit méritent d'être mentionnés ici

Des analyses opérées par l'Institut Vétérinaire afin de déceler la quantité de mercure contenu dans le foie et les reins d'oiseaux trouvés morts ou mourants, 50 % ont revélé s'inscrire entre les chiffres suivants : Faisans et Perdrix 28-150 mg kg ; Pigeons : 8-45 ; Corvidés : 29-110 ; Fringilles : 11-136 ; Rapaces diurnes : 6-100 ; Rapaces nocturnes : 4-270 mg/kg. Six œufs de Pygargue (*Haliaetus albicilla*), provenant de régions différentes, contenaient de 3,5 à 11 mg/kg. Du mercure a été également trouvé chez le renard, la martre, le putois, mais non chez le chevreuil et le lièvre. Même pour ces oiseaux tués à la chasse ou par accident et ne montrant aucun signe de maladie, les analyses se sont montrées positives. Sur 39 oiseaux se nourrissant de graines, on a trouvé du mercure dans 26 d'entre eux, et 50 % de ceux-ci présentaient de 1 à 39 mg/kg dans le foie. Sur 70 Autours et Buses, 67 ont donné des analyses positives ; 50 % des Autours donnaient de 6 à 53 mg/kg et les Buses de 2,1 à 65 mg/kg dans le foie. Des expériences faites sur les Faisans nourris de graines traitées au mercure ont prouvé une diminution du nombre d'œufs couvés avec succès. L'Institut Vétérinaire a prouvé statistiquement la valeur de ces analyses et expériences. Il est donc probable que le grand responsable de ce drame est l'enrobement des graines au mercure.

CLUTCH-SIZE IN TROPICAL PASSERINE BIRDS OF FOREST AND SAVANNA

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THEORIES OF CLUTCH-SIZE

As is well known, the passerine birds of the tropics tend to have much smaller clutches than those of the temperate zones (MOREAU 1944). On the theory supported by LACK (1947), this is because, in general, tropical birds can collect less food for their young than those of temperate regions, and the usual reason suggested for this is that in summer the diurnal birds of north-temperate regions have about 1 1/2 times as many hours each day in which to collect food as tropical species. But this difference, though undoubtedly important, is inadequate in itself to account for the whole difference, since in various passerine families the temperate zone species lay clutches of twice the size of their tropical congeners.

ASHMOLE (1961), accepting the idea that tropical species not only do not, but cannot, raise so many young as north temperate birds, postulated an additional reason for their inability. Among north-temperate birds, those which are sedentary are greatly reduced in number in winter by food shortage, while those which migrate are presumably reduced by the dangers incurred on migration. As a result, the breeding populations of such species tend to be low in relation to the seasonal flush of insects and other foods for their young in spring and summer. In relatively uniform tropical habitats on the other hand, there may be no marked seasonal food shortage, and in any species that is limited by its food supplies, the adult numbers will probably be close to the limit set by food throughout the year, so that there will not at any time be a big surplus of food out of which young

birds can be fed. Hence, the number of young that can be raised will be small.

ASHMOLE's postulate depends on the truth of two general theories, first that the numbers of passerine birds are limited in a density dependent way by their food supplies outside the breeding season, and secondly that the clutch size of each species has been evolved to correspond with that brood-size from which the food supply permits the greatest number of surviving young to be raised (LACK 1954). Both theories have, of course, been questioned, but there is not space here to discuss them in general. It is relevant, however, to note that both SKUTCH (1949) and WAGNER (1957, 1960) have argued that, while the above interpretation of clutch size might perhaps hold in temperate regions, it is not applicable to tropical passerine species. SKUTCH in particular claimed that tropical passerine species could normally collect much more food than is needed to raise broods of only two young. He therefore suggested that natural selection might operate against the evolution of a larger brood because the latter would entail more feeding visits by the parents, thus increasing the risk of the nest being found by predators.

ASHMOLE's postulate also depends on a third point, that the amount of food which can be brought by a pair of birds to their young is less when the density of breeding pairs is higher. This seems reasonable on general grounds. Also the Great Tit *Parus major* lays a smaller clutch at higher population densities (KLUIJVER 1951, LACK 1958), presumably because it cannot raise so many young at higher densities, and at least in one year near Oxford there was a much lower production of young in one wood with an exceptionally high density of breeding pairs than in another wood with a normal population density (PERRINS 1963).

It occurred to us that ASHMOLE's view could be tested by a comparison of clutch size within the tropics, between species breeding in evergreen forest, which provides the most uniform conditions, and those breeding in savanna and other drier habitats with a restricted rainy season. In the latter habitats, during the long annual drought, the trees to some extent lose their leaves while the ground cover becomes desiccated and is often removed by fire. Hence, though measurements have not been made, it seems certain that the food supplies diminish, and consequently that the birds become

much reduced in numbers between successive breeding seasons (cf. MOREL and BOURLIÈRE 1962). Since both forest and savanna are in the tropics, the complication of a difference in daylength is avoided. Actually MOREAU (1944) had already found that average clutches tend to be larger in savanna than forest, but much more extensive data are now available for the clutches of African species, suggesting that a fresh enquiry would be rewarding.

THE AFRICAN DATA

For the purposes of this comparison, we decided to limit ourselves to passerine species, and among these especially concerned ourselves with those families in which clutch size records were available for at least five species in forest and five outside forest, in order to avoid possible bias due to one or two exceptional species. The main sources of information are MOREAU (1944), who had already included all published records up to that date for East Africa, and CHAPIN (1953, 1954) primarily for the Congo but also summarising information from elsewhere. One family, the babblers *Timaliidae*, was inadequately represented in both these sources, so further information was taken from PRAED and GRANT (1955), while to obtain records from arid country, we consulted ARCHER and GODMAN (1961) for Somaliland. For the *Ploceidae* only, we undertook a wider search, covering all the standard regional ornithologies of tropical Africa.

Data for Africa were restricted to the tropical mainland, records from islands off the coast and also from South Africa being omitted. This was because islands do not provide ecological conditions comparable with the mainland, while clutches are in general higher in South than tropical Africa (MOREAU 1944). The full list of species utilised and their respective clutch-sizes are set out in Appendix 1, while the method of assessing the average clutch size for each family is set out in Appendix 2. The numerical assessment of clutch-size from the published data was a difficult and somewhat arbitrary procedure, but quantitative tabulation was essential for our purpose, and as we have published our figures, other workers can see what we have done. For a number of species later knowledge may show that our figures are somewhat wrong, while for others there are as yet too few records for

a firm conclusion, but there is no reason to think that any errors are in one direction rather than another, so that they should not affect the general trends discussed here

The main findings for tropical Africa are summarised in Table 1, of which the upper section fully confirms MOREAU's earlier conclusion that, in general, clutch sizes are lower in evergreen forest than in habitats outside it, most of the latter having deciduous vegetation and a well-marked dry season Of the eight families for which the averages rest on at least 5 species in each habitat, the non forest species have an average clutch-size of rather over half an egg more than the forest species in the *Estrildidae*, *Laniidae*, *Ploceidae*, *Timaliidae* and *Turdidae*, and there is a smaller difference in the same direction in the *Sylviidae*, but virtually no difference in the *Muscicapidae* or *Nectariniidae*.

The figures for two families need qualifying The higher average clutch-size of *Sylviidae* outside than in forest is due almost entirely to the 23 species of *Cisticola*, for which the average clutch-size was 2.9, and if this genus were omitted, on the grounds that none breed in forest, the average for the non forest species of *Sylviidae* would be reduced to 2.4, only a little larger than for the forest species. There are, of course, various other genera of *Sylviidae* which are restricted to one habitat or the other, and there are no grounds for excluding *Cisticola* rather than any of these others except that it contains so many species. Similarly in the *Ploceidae*, all 15 species of *Bubalornithinae* and *Passerinae* for which the clutch-size is known breed outside forest and have an average clutch-size of 3.5, whereas 44 species of *Ploceinae* which breed outside forest have an average clutch-size of 2.5, as compared with an average of 2.1 for the 8 forest species of *Ploceidae* (all in the subfamily *Ploceinae*) Thus, even when the comparison is restricted to the *Ploceinae*, the forest species have a smaller average clutch than those outside forest.

Suggestive evidence of a trend in the same direction was found in those families for which fewer than five species were available for comparison in both habitats In the *Sturnidae* (starlings), three forest species have an average clutch size of 2.7, compared with an average of 3.5 for 17 species outside forest. Again, in the *Hirundinidae* (swallows), *Dicruridae* (drongos), and *Fringillidae* (carduline finches), the

single forest species for which data are available has a smaller clutch than the average for respectively 17, 1 and 16 species breeding outside forest. But the 21 species of *Pycnonotidae* (bulbuls) which breed in forest lay clutches of two, like the single species outside forest. It is also suggestive that, except for the estrildines and carduelines, almost all passerine species breeding in forest have clutches of two, whereas the average clutch size is three eggs or more in nearly all the other tropical African passerine families which breed entirely outside forest, including the *Alaudidae* (larks), *Corvidae* (crows), *Paridae* (tits), *Certhiidae* (creepers) and *Motacillidae* (pipits, wagtails), while it exceeds two, though under three, in the *Oriolidae* (orioles).

In view of these general trends, it is surprising to find that nearly all the tropical African species of *Muscicapidae* have clutches of two, irrespective of habitat, the few exceptions being noted in Appendix 1. Again, none of 39 species of *Nectariniidae* has been recorded as laying a clutch larger than two eggs, but in this family a few species lay only one egg. Nearly all such records are from the eight species formerly kept together in the genus *Nectarinia, sensu stricto*, five of which, though not the others, are montane. Most other African sunbirds have since been brought within this genus (which was the earliest to be described in the family), but for convenience we have retained the former classification in Appendix 1. The latter also includes a few other species in which a clutch of one has been recorded.

If ASHMOLE's view is correct, then it might also follow that the species breeding in extremely arid habitats should lay larger clutches than those which, though also breeding outside forest, frequent less extreme habitats. There are records for a sufficient number of species to make such a comparison possible for two families, the *Alaudidae* and *Sturnidae*, and the lower section of Table 1 shows that, in both, the average clutch is over 1 ½ eggs lager in the very arid habitat of Somaliland than elsewhere in tropical Africa outside forest.

AN AMERICAN COMPARISON

SKUTCH (1954, 1960), working mainly in humid forest and cultivated land in Costa Rica, and MARCHANT (1960), working in the extremely arid Santa Elena peninsula in Ecuador,

obtained sufficient clutch records to permit us to make similar comparisons in relation to habitat for two tropical American families. As shown in Table 2, in both the *Tyrannidae* and the *Fringillidae*, the average clutch-size was rather larger for the species breeding in forest clearings and other more open habitats in Costa Rica than for the local forest species, and larger again for those breeding in the Santa Elena peninsula than in open habitats in Costa Rica. Hence both differences are in the same direction as in the equivalent habitats in Africa though each average is as yet based on rather few species in America.

Discussion

As mentioned in the introduction, Ashmole postulated that species living in a habitat with little seasonal change during the year would probably be close to the limit of numbers set by food almost throughout the year, and so would find it hard at any time to find enough additional food to raise young and hence would evolve small clutches. We predicted from this theory that the average clutch-size should be lower in tropical forest than in savanna, and this was found to be true in tropical Africa, while there was some confirmation from tropical America also. It does not necessarily follow from this that Ashmole's postulate is right, but the fact that it holds for a variety of passerine families in two continents is highly suggestive, and it may be added that Ashmole was evidently unaware of this difference between forest and savanna species when he wrote. Even so, there may well be additional factors modifying the size of brood which different species can raise, and in this context it is almost certainly important that the forest species of *Ploceinae*, and some of the forest species of *Estrildidae*, are insectivorous, whereas those of savanna eat mainly seeds. Doubtless further knowledge would show that there are other differences in ecology which help to account for the differences in clutch size between forest and non forest species in particular families. But as the generalisation holds for nearly all the families investigated here, it is reasonably certain that a general factor is involved in addition to any particular factors affecting some but not other species.

It should be added, however, that while in nearly all the

families investigated, the species breeding outside forest have larger clutches than those in the forest, the average difference is only about half an egg, *i.e.* about one quarter as much again This is a much smaller difference than might, perhaps, have been expected, at least from the impression that the observer gets of the relatively uniform conditions in forest on the one hand and the temporary flush of foods in savanna on the other hand. One would have supposed that the seasonal difference in food resources between the two environments would be much greater than in the proportion of 4 : 5, but actual measurements have not been made, and this superficial impression of the ecological situation might be fallacious. Alternatively there may be other factors modifying clutch and brood-size.

Since this paper provides support for Ashmole's view, it also provides support for the view that tropical species, like those of north temperate regions, raise as large broods as they are capable of feeding, and that they have evolved clutches to correspond. But this evidence is as yet purely circumstantial, and the experimental test of providing a tropical passerine species with a larger brood than its normal clutch-size has not been undertaken.

Summary

1. Ashmole suggested that one reason why tropical species have smaller clutches than those of temperate regions is that the tropical species live under nearly uniform conditions throughout the year, so that their numbers remain sufficiently close to the limit set by food for them to find it hard at any time to feed a brood, and accordingly, they have evolved small clutches Those of temperate regions, on the other hand, being reduced heavily in numbers in winter and therefore scarce relative to their food supplies in spring, can raise larger families and evolve larger clutches.

2. This difference should apply equally within the tropics to species breeding in evergreen forest and savanna respectively, as the latter experience a period of food shortage near the end of the dry season In fact such a difference holds in 6 out of 8 African passerine families in which the clutch-size is known for at least 5 species in each habitat, and there

is also suggestive evidence for it in four other African families represented by fewer species in one or other habitat, and in two tropical American families.

3 No difference in clutch-size between forest and savanna species was found in *Muscicapidae* or *Nectariniidae*.

4. In each of four families, two in Africa and two in America, the average clutch-size was larger in an extremely arid habitat than in less extreme conditions outside forest.

TABLE 1

Average clutch-size in different habitats in tropical Africa (number of species in brackets)

Family	Tropical Africa	
	forest	outside forest
Estrildidae (waxbills)	3.7 (10)	4.3 (32)
Laniidae (shrikes)	2.0 (5)	2.7 (26)
Muscicapidae (flycatchers)	2.0 (15)	2.2 (22)
Nectariniidae (sunbirds)	1.9 (11)	1.7 (33)
Ploceidae (weavers)	2.1 (8)	2.8 (59)
Sylviidae (warblers)	2.2 (14)	2.6 (51)
Timaliidae (babblers)	2 0 (5)	2.7 (9)
Turdidae (thrushes)	2.0 (11)	2.7 (26)
	other non-forest	arid Somaliland
Alaudidae (larks)	2.1 (6)	3.7 (14)
Sturnidae (starlings)	3.0 (12)	4.2 (7)

Notes · Among the non forest *Ploceidae*, 44 species of *Ploceinae* had an average clutch size of 2.5 and 15 species of *Bubalornithinae* and *Passerinae* of 3.5. Among the non forest *Sylviidae*, 23 species of *Cisticola* had an average clutch size of 2 9 and 28 other species of 2 1

TABLE 2

Average clutch-size in different habitats in tropical America (number of species in brackets)

Family	Mainly humid Costa Rica		Very arid
	forest	others	S W. Ecuador
Fringillidae (finches)	1.9 (3)	2.2 (5)	3.0 (6)
Tyrannidae (tyrant-flycatchers)	2.1 (6)	2.5 (20)	2.9 (8)

APPENDIX

Clutch-size records used for tables 1 and 2

Note : A single number or two numbers joined with a hyphen refer to general statements on clutch-size, e. g. 3 means normal clutch 3, 4-5 means normal clutch 4 or 5. In such cases very unusual clutch-sizes are omitted. A number with another in brackets means that the latter is less frequent, e. g. 3(4), while if the second number is in double brackets it is unusual. One number followed by a stroke and then a second number, e. g. 1/4, means one record of a clutch of 4; this notation is used only when very few records (which might perhaps be atypical) have been published. Within each family the genera, and within each genus the species, have been listed alphabetically. For convenience we have followed the nomenclature used by the authors cited, basically Chapin 1953, 1954, and Moreau (1944). Two specific names joined by + mean that two forms formerly classified as separate species are now united in one.

TROPICAL AFRICA

Estrildidae

Forest : Insectivorous *Nigrita bicolor*, 1/4, 1/5, *canicapilla* 4, *fusconota* 1/6, *Parmoptila woodhousei* 3-4, *Pholidornis rushiae* 2; Others : *Cryptospiza reichenowi* + *australis* (2) 3, *salvadori* 2/4, *Estrilda atricapilla* 1/5, *Hypargos niveoguttatus* 1/3, *Spermophaga ruficapilla* 1/3.

Non-Forest : *Amandava subflava* 4-5, *Clyptospiza monteiri* 6, *Coccopygia quartina* + *melanotis* (3) 4, *Estrilda astrild* 4-5, *melpoda* 5-6, *nonnula* 4-6, *paludicola* 4-5, *troglodytes* 6, *Euodice cantans* 1/5, 1/6, *Granatina ianthinogaster* 3-5, *Lagonosticta jamesoni* 3-4, *larvata* + *togoensis* 3-4, *perreini* 3-4, *rara* 1/4, *rubricata* 3-5, *rufopicta* 3/4, *senegala* 3-5, *troglodytes* 6, *Lonchura bicolor* + *nigriceps* 4-6, *cucullata* 4-6, *fringilloides* 1/6, *Nesocharis ansorgei* 1/2, *Ortygospiza atricollis* 3-6, *locustella* (3) 5, *Pirenestes ostrinus* (3) 4, *Pytilia afra* 3-4, *melba* 4-5, *phoenicoptera* 3/4, *Spermophaga haematina* 3, *Uraeginthus angolensis* 3-6, *bengalensis* 4, *cyanocephalus* 1/3.

Laniidae

Forest : *Chlorophoneus bocagei* 1/2, *nigrifrons* 1/2, *Laniarius leucorhynchus* 2, *Malaconotus lagdeni* 1/2, *Nicator chloris* 2.

Non-Forest : *Antichromus minutus* 2(3), *Corvinella corvina* 4(5), *Chlorophoneus sulfureopectus* 2, *Dryoscopus cubla* 2-3, *gambensis* 2, *pringlii* 1/2, *Eurocephalus anguitimens* 2-4, *Laniarius erythrogaster* 2, *ferrugineus* 2(3), *funebris* 3, *lühderi* 2, *ruficeps* 1/3, *Lanius cabanisi* 3-4, *collaris* 2-4, *excubitorius* 3-4, *mackinnoni* 2(3), *somalicus* 4, *souzae* (2) 3, *Malaconotus cruentus* 2-3, *poliocephalus* (2) 3, *Nilaus afer* 2, *Prionops cristata* + *poliocephala* 1/5, *retzii* 2, *Tchagra australis* 2(3), *jamesi* 2-3, *senegala* 2(3).

Muscicapidae

Forest : Alt 2 : *Alseonax epulatus*, *seth-smithi*, *Dioptrornis fischeri*, *Dyaphorophyia blissetti*, *castanea*, *chalybea*, *Fraseria ocreata* *Pedi*

torhynchus comatus, Terpsiphone rufocinerea nigriceps, Trochocercus albonotatus, albonotatus, cyanomelas, nigromitratus, nitens, also *Alseonax adustus + minimus* (1) 2 (3).

Non Forest laying 2 . *Alseonax aquaticus, cassini, Artomyias fuliginosa, Batis minor, molitor, Bias musicus, Bradornis griseus, microrhynchus, Elminia albicauda, longicauda, Hyliota flavigaster, Hypodes cinerea, Melaenornis edolioides, Muscicapa gambagae, Parisoma lugens Platysteira cyanea.*

Non Forest others . *Batis orientalis* 1 2, 1 3, *Bradornis pallidus* 2 3, *Hyliota australis* 1/3, *Melaenornis pammelaina* 2 3, *Myopornis böhmi* 1/4, *Terpsiphone viridis + perspicillata* 2-3

Nectariniidae

Forest a laying 2 *Anthreptes aurantium tephrolaema, Cinnyris mediocris, minullus, superbus, Cyanomitra batesi, cyanolaema, olivacea, seimundi*; (b) others : *Anthreptes gabonicus* ((1)) 2, *gokanae* 1/1.

Non Forest laying 2 : *Anthreptes anchietae, collaris, longuemari, Chalcomitra amethystina, angolensis, fuliginosa, rubescens senegalensis, Cinnyris chloropygius coccinigaster, cupreus, johannae, osea reichenowi, shelleyi, venustus, Cyanomitra verticalis, Hedydipna platura* (Archer and Godman quoted 3 for the Sudan without citation, so we have ignored it).

Non-Forest others : *Chalcomitra hunteri* 1/1, *senegalensis* ((1)) 2, *Cinnyris albiventris* 2/1, *afer* 2 1 2 sometimes 1 even in South Africa, *bifasciatus* (1 2, *habessinicus* 1 ((2 , *Cyanomitra reichenbachii* 2 1, *Nectarinia erythrocerca* 1 (2 , *famosa* 1 2, *johnstoni* 1, *kilimensis* 1 (2 , *nectarinioides* 1-2, *pulchella* 1-2, *reichenowi* 1, *tocazzae* 1.

Ploceidae

Forest ploceinae : *Malimbus malimbicus* 2, *nitens* 2 (3), *scutatus* 2, *Ploceus aliensis* 2, *bicolor* 2-3, *insignis* 2, *melanogaster* 2, *nigricollis* (1) 2.

Non-Forest Ploceinae : *Amblyospiza albifrons* 2-3, *Euplectes afra* 2 4, *albonotatus* 2 3, *anomala* 2/2, *ardens* 2 3 4), *axillaris* 2-3, *capensis* 2 3, *gierowii* (2)3 (4)), *hartlaubi* 2, *hordeaceus* 2 4, *jacksoni* 2 3, *macrourus* 2 4, *nigroventris* 2 3, *oryx* 2-4, *progne* 2 1, *Malimbus rubriceps* 3, *Ploceus aurantius* 2, *baglafecht* 2 3), *bertrandi* 2, *bojeri* 2, *castaneiceps* 2 3), *castanops* 2,3), *cucullatus* 2(3), *galbula* 3, *heuglini* 2, *intermedius* 2, *jacksoni* 2(3), *luteolus* 2 3, *melanocephalus* 2 3), *nigerrimus* 2(3), *ocularis* 2((3)), *pelzelni* 2-3, *rubiginosus* 3 4, *spekei* 3, *subaureus* 2 4, *superciliosus* 3(4), *taeniopterus* 2(3), *velatus* 2(3), *vitellinus* 2 3, *xanthops* 2, *xanthopterus* 2, *Quelea quelea* 3, *cardinalis* 2 3, *erythrops* 2-3,

Non Forest Bubalornithinae · *Bubalornis albirostris* 2 3, *Dinemellia dinemelli* 3-4,

Non Forest Passerinae : *Histurgops ruficauda* 3, *Passer castanopterus* 5-7, *eminibey* 3-4, *griseus* 3-4, *iagoensis* 3-4, *luteus* 3-6, *Petronia brachydactyla* 3 5, *superciliaris* 3-4, *Plocepasser mahali* 2 3, *superciliosus* 2-3, *Sporopipes frontalis* 3 1, *Pseudonigrita arnaudi* 3, *cabanisi* 2 4

Sylviidae

Forest : *Apalis binotata* 2, *jacksoni* 1/2, *pulchra* 2(3), *thoracica* 2 2, *Camaroptera chloronota* 1/2, *superciliaris* 1/3, *Hylia prasina* 1 2, *Pri*

nia bairdii 3, *Sathrocercus mariae* 2, *Seicercus ruficapilla* 3, *umbrovirens* 1/3, *Sylvietta denti* 1, *leucophrys* 1/2, *virens* 2(3).

NON-FOREST other than *Cisticola* : *Apalis flavida* 2-4, *rufifrons* 1/3, 1/4, *Acrocephalus baeticatus* 2, *Bradypterus brachypterus* 2, *cinnamomeus* 1/2, 1/3, *Calamocichla gracilirostris* 2(3), *parva* 2, *rufescens* 2-3, *Camaroptera brevicaudata* 2(3), *simplex* 1/3, 1/4, *Chloropeta natalensis* 2(4), *similis* 1/2, *Eminia lepida* 2-3), *Eremomela canescens* 1/1, *icteropygialis* 1/3, *griseoflava* 2/2, *Heliolais erythroptera* 1/2, *Melocichla mentalis* 2, *Phyllolais pulchella* 2, *Prinia leucopogon* 2-3, *mistacea* 3(4), *somalica* 4, *subflava* 2-4, *Schoenicla brevirostris* 2, *Sylvietta brachyura* 2, *isabellina* 2(3), *ruficapilla* 1/2, *whytii* 2.

NON-FOREST *Cisticola* : *angusticauda* 3-4, *anonyma* 2, *aridula* 1/4, *ayresii* 3-4, *brachyptera* (2)3, *brunnescens* 2-3, *bulliens* 3, *cantans* 3-4, *chiniana* 3, *chubbi* (2)3, *dambo* 2-3), *emini* 3, *erythrops* 2-3, *erimia* 2-3, *galactotes* 3-4, *juncidis* 3-4, *lateralis* 2-3, *natalensis* 2-3, *pipiens* 3-4, *robusta* 2-3, *rufilata* 2-3, *tinniens* 3, *woosnami* 2.

Timaliidae

FOREST all 2 : *Malacocincla cleaveri*, *fulvescens*, *rufipennis*, *Pseudoalcippe abyssinica*, *Ptyrticus turdinus*.

NON-FOREST : *Argya aylmeri* 2-3, *rubiginosa* 2-4, *Turdoides hypoleuca* 3(4), *jardinei* 1/3, *leucopygius* 3, *melanops* 2-3, *plebejus* 2-3(4), *reinwardii* 2, *tenebrosus* 2-3.

Turdidae

FOREST : *Cossypha bocagei* 1/2, *cyanocampter* 2, *Geokichla piaggiae* 1/2, *Illadopsis rufipennis* 1/2, *stictigula* 2, *Neocossyphus rufus* 1/2, *Pogonocichla stellata* 2(3), *Sheppardia cyornithopsis* 1/2, *sharpei* 2, *Turdus abyssinicus* 2, *olivaceus* 2(3).

NON-FOREST : *Cercomela familiaris* 3-4, *melanura* 3, *Cercotrichas podobe* 2-4, *Cichladusa arquata* 2, *guttata* 2, *ruficauda* 1/2, *Cossypha caffra* 2-3, *heuglini* 2-3, *niveicapilla* 2-3), *natalensis* 2-3, *Erythropygia barbata* 2-3, *galactotes* 1/3, *hartlaubi* 1/2, *leucophrys* 2-3, *Myrmecocichla arnotti* 3(4), *nigra* 1/2, 1/3, *Monticola angolensis* 3-4, *rufocinerea* 1/4, *Oenanthe albifrons* 2-3, *phillipsi* 2-3, 1/4, *pileata* 3, *schalowi* 3, *Saxicola torquata* (2-3-4, *Thamnolea cinnamomeiventris* 2, *Turdus libonyanus* (2)3, *ludoviciae* 2/2.

Alaudidae

SOMALILAND : *Ammomanes deserti* 3-4, *Calandrella rufescens* 4-5, *Certhilauda alaudipes* 3, *hammertoni* 3, *somalica* 1/3, 1/4, *Eremopterix nigriceps* 4, *signata* 4(5), *Galerida cristata* 4-5(6), *theklae* 4-5, *Heteromirafra ruddi* 3, *Mirafra cantillans* 4, *collaris* 3, *gilletti* 3, *Pseudalaemon freemantlii* 1/3, 1/4

OTHER TROPICAL : *Calandrella cinerea* 2, *Eremopterix leucopareia* 2-3, *verticalis* 2-3, *Heterocorys modesta* 2/1, *Mirafra africana* 2-3, *rufocinnamomea* + *fischeri* 2(3).

Sturnidae

FOREST : *Lamprotornis corruscus* 3, *purpuropterus* 2(3), *Poeoptera lugubris* 1/3.

SOMALILAND : *Buphagus erythrorhynchus* 2-3, *Cosmopsarus regius* 4-6, *Lamprocolius chalybeus* 4, *Onychognathus blythii* 4-5), *Speculipastor bicolor* 3-4, *Spreo albiceps* 5-6, *shelleyi* 4-5(6), *superbus* 4.

Other Non Forest : *Buphagus africanus* 2-3, *erythrorhynchus* 2-3, *Cinnyricinclus leucogaster* 2-3, *Creatophora cinerea* 2-3, *Lamprocolius chalybeus* 2-4(5), *splendidus* 2-3, *Lamprotornis caudatus* 2-4, *Onychognathus morio* 3, *tenuirostris* 3-4, *Spreo hildebrandi* 3-4, *pulcher* 3-5, *superbus* 2-4.

TROPICAL AMERICA

Fringillidae

Forest : *Arremon aurantiirostris* 2, *Atlapetes torquatus* 2, *Cyanocompsa cyanoides* (1)2,

Open Woodland : *Saltator maximus* 2

Non Forest : *Arremonops conirostris* 2((3)), *Saltator albicollis* 2, *Sporophila aurita* 2, *torqueola* 2(3), *Tiaris olivacea* 2-3

Santa Elena : *Neorhynchus peruvianus* 2,3, *Pheucticus chrysopeplus* 2-4, *Poospiza hispaniolensis* 3-4, *Rhodospingus cruentus* 3(4), *Sporophila telasco* 2-3, *Volatinea jacarina* 3.

Tyrannidae

Forest : *Myiobius sulphureipygius* 2, *Onychorhynchus mexicanus* 2, *Pipromorpha oleaginea* 2/3, *Platyrhinchus coronatus* 2, *Rhynchocyclus brevirostris* 2, *Terenotriccus erythrurus* 2/2

Forest and open : *Megarhynchus pitangua* 2-3.

Non Forest (Central America) : *Capsiempsis flaveola* 2, *Contopus cinereus* 2-3, *Elaenia chiriquensis* 2, *flavogaster* 2, *Legatus leucophaius* 2(3), *Myiarchus tuberculifer* 2/4, *Myiobius atricaudus* 1-2, *Myiodynastes luteiventris* 1-3, *maculatus* (2-3, *Myiophobus fasciatus* 2, *Myiozetetes cayanensis* 2-3, *granadensis* (2)3, *similis* (2)3-4, *Sayornis nigricans* 2-3, *Serpophaga cinerea* 2, *Todirostrum cinereum* (2-3, *sylvia* 2, *Tolmomyias sulphurescens* 2-3, *Tyranniscus vilissimus* 2, *Tyrannus melancholicus* 2-3.

Santa Elena : *Camptostoma obsoletum* 2(3), *Elaenia leucospodia* (2)3, *Euscarthmus meloryphus* 2, *Muscigralla brevicauda* 3-5, *Myiodynastes bairdi* 4(5), *Phaeomyias murina* 2, *Pyrocephalus rubinus* (2)3, *Tyrannus niveigularis* (2)3-4

APPENDIX 2

Method of calculating average clutch-sizes for table 1

In calculating the average clutch-size for each family in each habitat, the average for each species recorded in Appendix 1 was given equal value, i.e. each was reckoned as one figure irrespective of the number of records on which it was based. The score used for the clutch-size of each species in calculating the average is best illustrated by actual examples thus: 3 was scored as 3, 2-3 as 2.5, 2(3) as 2.25, (2)3 as 2.75, 2,3(4) as 2.75, 2((3)) as 2.1. The total for all the species in each group was then summed and divided by the number of species involved. Hence the average for each group is the average of the averages for all the species involved.

RESUME

1°, ASHMOLE suggère qu'une des raisons pour lesquelles les pontes d'espèces tropicales sont plus petites en nombre que celles des espèces vivant en région tempérée tient au fait que les espèces tropicales vivent toute l'année dans des conditions à peu près uniformes. Le nombre d'individus reste donc voisin des limites permises par la quantité de nourriture à leur disposition. Il en résulte qu'il leur est difficile d'élever une nichée, alors que dans les régions tempérées le nombre des individus étant fortement réduit par l'hiver, donc faible pour la nourriture offerte au printemps, ces derniers peuvent élever des familles plus importantes, d'où ponte plus forte.

2° Cette différence se retrouve entre les espèces tropicales qui se reproduisent soit en forêt soit en savane. Ce dernier biotope traverse une période de disette à la fin de la saison sèche. En fait c'est vrai pour 6 des 8 familles de Passereaux africains dont on connaît le chiffre des pontes pour au moins 5 espèces dans chaque biotope Il semble qu'il en soit de même pour 4 autres familles représentées par un nombre moins important d'espèces dans chacun des deux habitats ainsi que pour 2 familles tropicales américaines

3°) Cette différence n'existe pas entre les espèces de forêt et de savane chez les Muscicapidés et les Nectariniidés.

4°) Dans chacune des 4 familles, 2 d'Afrique et 2 d'Amérique, la moyenne du nombre d'œufs par ponte est plus forte en zone aride que dans les zones au climat moins rigoureux quoique non forestier.

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CLASSIFICATION, IDENTIFICICATION AND SEQUENCE OF GENERA AND SPECIES

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Much has been written in recent years about zoological classification. What is the purpose of classifying ? How should the findings of the taxonomist be presented ? In what sequence should species, genera, and families be listed in faunal lists and catalogues ? Regrettable as this is, it seems as if every generation has to face this problem anew.

The fact that various kinds of organisms are clustered in natural groups, was known long before scientific classifications existed. One does not need to be a zoologist to know that there are birds and butterflies, hawks and ducks. Already the Greek philosophers speculated on the reasons for the existence of « natural groups ». In the 18th century the question of classification was foremost in the minds of the naturalists. The Aristotelians and their followers, including LINNAEUS, thought that taxa were natural because they reflected an underlying essence (the ideas of PLATO) which had reality. The nominalists, on the other hand, with whom BUFFON and ADANSON sympathized, insisted that only individuals had reality, and that taxa were merely the creation of Man's ordering mind. Neither interpretation was particularly satisfying, and in the 100 years after 1758 practising zoologists refused to be burdened unduly by philosophical speculations. Instead, they classified organisms into the groups which seemed readily distinguishable by combinations of obvious characteristics. CUVIER's recognition of four « embranchements » was one of the most important steps forward in the classification of animals. Many other zoologists made contributions to zoological classification that were hardly less important. The category of the family (unknown to LINNAEUS) was introduced into taxonomy around 1800 and the number of higher

taxa, from protozoans to mammals, recognized by zoologists rose rapidly. Students were attempting to design a « natural system », that is to recognize taxa which consisted of species resembling each other in the greatest possible number of characters. They had no theory, however, that would explain why it was possible to construct a hierarchy of taxa, as is the natural system.

It was not until after 1859 that general agreement was reached on the meaning of the higher taxa : Organisms fall into natural groups when they are the descendants of a common ancestor. This concept gave new meaning to taxonomic activity ; it provided a working hypothesis to the taxonomist, who would ask himself « do the similarities of the organisms which I place in a single group indicate that they descended from a common ancestor ? » The theory of classification now had a solid basis.

This by no means resolved all the difficulties. One reason for this is that classifying has two rather different objectives. One is purely practical. A classification attempts to provide us with an arrangement to facilitate the identification of specimens and their convenient sorting and storage in museum collections. As important as this practical aspect is, it is neither the only nor, perhaps, the most important one. The other aspect is that a classification must have an explanatory value. Every new classification is, so to speak, a new taxonomic theory. Since we know that natural groups exist in nature only because all organisms are the products of evolution, it is our task, as scientists, to find what these groups are. It is our obligation to propose classifications which incorporate our researches on the most natural grouping of species and on the delimitation of such groups. Such classifications are of the nature of working hypotheses and are likely to be superseded when better information becomes available. In this respect our work is in no way different from that in other branches of science. Nothing in science is ever final, nothing is every definitive. Every new scientific theory is an attempt to improve our understanding of nature, but it must be tested against new observations again and again, and must be revised if it fails to explain the new observations. This is as true for every classification as it is for other scientific theories. If new characters show that a previously proposed classification is artificial, if it shows that a given species is pla-

ced in the wrong species group or genus, then we must revise our classification in order to restore concordance with the new facts.

This places us in a dilemma. For practical purposes we would like a completely stable classification, yet as scientists we cannot ignore improvements in our understanding of relationships. What shall we do ? But this is not our only trouble. Evolution produces evolutionary trees, a multi-dimensional phenomenon, while a classification is always a linear sequence, a one-dimensional phenomenon. Even if we had a perfect understanding of evolution (which we do not have even in the best know groups), we would nevertheless be forced to adopt a linear sequence in which by necessity unrelated species are often placed next to each other. Yet, there is no other way of printing a list of species, or arranging specimens in museum trays, than a linear sequence.

Any list is a reference work, yet nothing is more annoying than to find that each of 3 or 4 lists one needs to consult, has adopted a different sequence. As MOREAU (1961) points out quite correctly, it is difficult and time consuming to find a given species in such lists if every author adopts a different sequence. There are now some 5 or 6 different sequences of Passerine families in use at the present time. Some of these were proposed without the slightest published justification for the deviation from the last preceding list. This approaches scientific anarchy.

What can be done to straighten out this chaos ? MOREAU's suggestion has the unquestioned advantage of simplicity : Let us abandon all attempts to arrange species and genera according to presumed relationships, he proposes, but list them instead alphabetically, as was done by GESNER and TURNER 400 years ago. If there is so much uncertainty about relationship, as is indicated by the differences of opinion, why not give up all pretense of trying to find a natural classification, he says, and adopt instead the simple and objective method of listing species and genera alphabetically ? The more so, since in many cases we have no information whatsoever that would permit us to determine for a given species, genus, or family what its nearest relative is.

Even though alphabetical lists of species are virtually unknown in ornithology, they are widespread in other branches of zoology, although usually only in name cata-

logues rather than in monographic revisions. In those groups of insects, in particular, where a single genus may contain hundreds if not thousands of species, and where no good revision is as yet available, such an alphabetic arrangement is sometimes a necessity. But are the failings of natural classification in ornithology really so grave that it would be advantageous to go back to the alphabetical system which ornithologists had given up 400 years ago?

To me it seems that an alphabetical system has far more short-comings than advantages. Let me mention some of these disadvantages. In collections it would place next to each other species that are neither similar nor closely related. Every time the name of a species is changed for nomenclatural reasons, one would have to place it in a very different museum drawer, according to the first letter of its now valid species name. Every time the rank of a taxon is changed, as when a species is reduced to the rank of a subspecies, or a subspecies raised to that of a species, such a taxon would have to be shifted in the collections. The sequence of species in faunal lists would have to be changed for the same reasons. This would inevitably cause all sorts of inconveniences.

Far more important is the fact that an alphabetical arrangement lacks the great heuristic value of a natural (= evolutionary) arrangement. By demanding that the most closely related species be placed next to each other, the theory of a natural arrangement continues to pose the question of relationship. Is species *b* so similar to species *a*, perhaps because it is only a subspecies of *a*, rather than a good species? Are species *c*, *d*, and *e*, which are so similar to each other, perhaps members of a single superspecies? Is species *k* which looks so different from species *a* to *i* perhaps a member of a different genus? The requirement for placing species into natural groups does not permit the intellectually lazy solution of an alphabetical sequence. It demands decisions, it demands continuous study. No modern study of speciation can be undertaken, unless based on a natural grouping of species. The splendid analysis of species in the genus *Francolinus* (HALL, 1963), for instance, could not have been undertaken without the prior sorting of the species into natural groups. The same is true for KEAST's (1961) analysis of the birds of Australia and all other modern speciation studies in birds. They are all based on a natural grouping of species.

There is one other very important reason for the scientific prestige of « natural » arrangements. The more we utilize taxonomic characters that can not be found in bird skins, but require the study of the living bird, his song, courtship habits, his biochemical constituents etc., the more important it becomes to test these new findings against those of morphological museum research. An alphabetical sequence of species would be of little use to someone doing comparative studies of serum proteins or of homologous bird calls. For all these reasons it seems to me that the traditional endeavor to discover and delimit natural groups, groups of related species, is still by far the best approach in classification. If taxonomy wants to maintain its role as a legitimate branch of biological science, it cannot abandon the endeavor to try to improve its theories, its classifications. Yet, this brings it at once into immediate conflict with one of the functions of classification, ease of reference. This function of a classification is, indeed, greatly weakened by the incessant changes in the sequence of species and genera. No taxonomist (including the writer of these lines) is innocent of this criticism. What can we do about it ? Perhaps we should all agree not to publish any changes of standard classifications, of standard sequences (not necessarily the last published one !), until such changes have been formally adopted by a committee of the International Ornithological Congress. It is important to stress in this connection, as I have emphasized previously (MAYR, 1958), that a sequence is not a classification.

The compromise then would be to adopt the principle of natural classifications, but not to permit every author to reshuffle the sequence of species, genera and families every time he has an « inspiration » that a different sequence would be « much better ». Even though the highest purpose of a classification is the explanatory one, we must never forget that classifications also have a practical purpose, and this is of course particularly true of sequences such as are adopted in faunal lists and in checklists.

RESUME

Tous les êtres organisés peuvent être classés en groupes naturels basés sur la filiation.

Toute classification doit avoir à la fois : un rôle explica-

tif, basé sur la filiation et la parenté, et un rôle pratique permettant l'identification et la mise en ordre des spécimens. Le rôle scientifique entre parfois en conflit avec le rôle pratique lorsque de nouvelles connaissances entraînent la modification de la classification préalablement admise.

On cherche parfois à limiter le rôle de la classification à son objectif purement pratique en classant espèces et genres par ordre alphabétique.

Ceci ne semble pas désirable pour des raisons non seulement scientifiques mais également pratiques. Les modifications de nomenclature et de taxonomie entraînent des changements même dans la séquence alphabétique. Le plus grand avantage du système alphabétique tient dans le fait qu'il n'a pas une valeur intrinsèque qui demande continuellement à être examinée et améliorée.

Plus une classification demeure adoptée longtemps, mieux elle peut servir à des fins pratiques. Une classification ou une séquence taxonomique couramment acceptée ne devrait donc être changée que lorsque de nouveaux faits viennent apporter des preuves de son caractère erroné.

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ZUR TAXONOMIE VON *CINCLUS CINCLUS*
EIN TIERGEOGRAPHISCHES PROBLEM

von Günther NIETHAMMER
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Zwischen Nord- und Südspanien können bedeutende tiergeographische Unterschiede festgestellt werden, die dem sehr unterschiedlichen Klima zwischen beiden Teilen der Iberischen Halbinsel entsprechen. Das nördliche Küstenland Spaniens gehört zu den regenreichsten Gebieten Europas, Mittel und Südspanien hingegen sind relativ trocken. Die nordspanischen Gebirge bilden als natürliche Fortsetzung der Pyrenäen nach Westen mit diesen zusammen eine zoogeographische Einheit. Das kommt zum Ausdruck durch eine Anzahl eurosibirischer Arten aus vielen Tierklassen, die in den Pyrenäen und nordspanischen Gebirgen, nicht aber sonst auf der Iberischen Halbinsel vorkommen. Beispiele hierfür liefern unter den Säugetieren *Rupicapra rupicapra*, *Sorex minutus* (*), *Neomys fodiens* (*), *Micromys minutus* (*), *Clethrionomys glareolus* (*), *Arvicola terrestris* (*), *Microtus agrestis* (*) und *Apodemus flavicollis* (*), unter den Vögeln *Tetrao urogallus*, *Scolopax rusticola*, *Dryocopus martius*, *Anthus trivialis*, *Lanius collurio*, *Locustella naevia*, *Phylloscopus trochilus*, *Saxicola rubetra*, *Turdus philomelos*, *Parus palustris* und *Pyrrhula pyrrhula*. Etliche auf Nordspanien beschränkte Säugetiere haben im Süden einen naheverwandten Repräsentanten wie *Arvicola terrestris*   *A. sapidus*, *Talpa europaea*   *T. caeca*, *Microtus arvalis*   *M. cabrerae* und *Neomys fodiens* — *M. anomalus*.

Diese Unterschiede im Artenbestand werden noch deutlicher gemacht durch den Umstand, dass manche auf der Iberischen Halbinsel weitverbreitete Arten im N und S verschiedene Subspecies ausgebildet haben. Bei vielen Kleinsäugern ist eine Verdunkelung des Felles entsprechend den

(*) Dieses Arten haben wir 1963 zum ersten Male in Nordspanien gefunden (J. NIETHAMMER, *Z. Säugetierkunde*, 1964, pp. 193-220).

hohen Niederschlägen in Nordspanien offensichtlich, bei den Vögeln ist dies nicht nachgewiesen oder doch weniger deutlich. Ein schönes Beispiel für eine klare rassische Differenzierung zwischen den Populationen von N und S geben die beiden Unterarten der Schwanzmeise, *Aegithalos caudatus taiti* und *irbii*, die Vaurie sogar zwei verschiedenen Rassengruppen zuteilt. Andere Beispiele zeigen eine nur schwache Differenzierung der Populationen wie etwa (die in N-Spanien lebende Rasse jeweils zuerst genannt) *Oenanthe oenanthe oenanthe* und *nivea*, *Sitta europaea caesia* und *hispaniensis*, *Parus caeruleus caeruleus* und *ogliastrae* sowie *Parus ater ater*, *vieirae* und *cabrerae*. Es gibt unter den Vögeln auch Arten, deren iberische Unterart über die ganze Halbinsel von S bis N verbreitet ist. Beispiele hierfür sind *Phylloscopus collybita brehmi* und *Phoenicurus ochruros aterrimus*. Diese letztere Rasse gehört zu jener nicht sehr zahlreichen Gruppe von Unterarten, die im Felde von ihren geographischen Vertretern sicher unterschieden werden können wie etwa Nebel- und Rabenkrähe, Haus- und Italiensperling. Ich habe in den Karstbergen von Ramales de la Victoria in Nordspanien im April 1963 Männchen des Hausrotschwanzes gesehen und wiederholt eingehend beobachtet, die einen kohlschwarzen Rücken und Scheitel hatten und darin sogar dem dunklen Extrem von *Ph. o. aterrimus* glichen.

Ein deutlich gekennzeichnetes Rassenpaar wurde in Spanien dagegen bei der Wasseramsel konstatiert. Als erster hat dies Witherby (1922, 1928) klar erkannt. 1957 pflichtete ich ihm auf Grund neuen Materials aus Süd- und Nordspanien bei, wogegen Vaurie zunächst (1955) auf der ganzen Iberischen Halbinsel nur eine Rasse der Wasseramsel anerkennen wollte. 1958 revidierte er aber seine Ansicht und schloss sich gemeinsam mit Greenway der Auffassung Witherbys an. Ich hatte 1963 und 1964 Gelegenheit, Wasseramseln in Nord-, Mittel- und Südspanien zu sammeln, nämlich 2 bei Ramales de la Victoria, 1 in der Sierra de Guadarrama (Südhang), 2 in der Sierra de Cazorla und 1 (durch Dr. Abs) in Linares bei Salamanca. Diese konnte ich mit dem schon im Museum Koenig, Bonn, vorhandenen Material (insbesondere aus Valladolid) und einer Serie aus den Pyrenäen, die mir Dr. Macdonald freundlicherweise aus dem British Museum, London, lieh, vergleichen.

Alle nördlich Madrids und in den Pyrenäen gesammelten

Stücke sind dunkelbauchig, die südspanischen rostbäuchig und nicht von typischen *aquaticus* zu unterscheiden.

Ganz Nordspanien und die Pyrenäen nimmt also eine dunkelbauchige Form vom *cinclus*-Typ ein, die Gebirge Südspaniens eine rostbäuchige Form vom *aquaticus*-Typ. Das Verblüffende hierbei ist, dass die dunkelbäuchigen spanischen Wasseramseln nicht oder kaum von skandinavischen *C. c. cinclus*, die rostbäuchigen nicht von mitteldeutschen *C. c. aquaticus* zu unterscheiden sind, obwohl die jeweils ähnlichen bzw. gleichen Populationen (Nordeuropa — Nordspanien, Mitteldeutschland — Südspanien) keine Verbindung miteinander haben. Wie ist dieses Verbreitungsbild entstanden ? Es gibt zwei Möglichkeiten es zu deuten, nämlich — ökologisch — als Ergebnis konvergenter Entstehung jeweils zweier gleicher Rassen in den *heutigen* Arealen oder — historisch — als Ergebnis einer Arealaufspaltung zweier einst kontinuierlich verbreiteter Rassen. Die erste Deutung wurde gestützt, wenn die ökologischen Bedingungen, unter denen jeweils gleichgefärbte Populationen leben, gleich oder ähnlich wären. Das ist offensichtlich nicht der Fall : für die Alpen, Pyrenäen und Kantabrischen Gebirge sind z. B. die klimatischen Faktoren ähnlich, aber wir finden hier 2 Rassen ; in den Alpen und Gebirgen Südspaniens ist das Klima unterschiedlicher, aber die Wasseramseln sind hier wie da rostbäuchig.

Aus der heutigen Verteilung der beiden Rassen bzw. Rassengruppen (sowohl unter den dunkelbauchigen wie unter den rostbäuchigen Populationen sind jeweils mehrere recht schwach unterschiedene Formen beschrieben worden) ist weder ersichtlich, wo sie entstanden und ursprünglich verbreitet waren, noch welche Ausbreitungs- oder Rückzugswege sie genommen haben. Auffallend ist nur, dass Kleinasien genauso wie Iberien von beiden bewohnt wird (1), und zwar jeweils von *cinclus*-artigen im Norden und *aquaticus*-artigen im Süden. So ist *C. c. cinclus* auf 3 weit voneinander isolierte Areale verteilt, nämlich erstens Skandinavien samt Baltikum bis Ostpreussen, zweitens Nordostkleinasien und drittens Pyrenäen, Nordspanien und die beiden Inseln Korsika und Sardinien. Zwischen diese 3 Bereiche erstreckt sich als breite Zone von Schottland und Irland bis Peloponnes

(1) *C. c. amphytrion* (aus Lasistan) ist nicht von *cinclus* zu unterscheiden. Dagegen gehören Wasseramseln aus dem Taurus zur *aquaticus* Gruppe (KUMERLOEVE, 1961).

und Sizilien das Areal von *C. c. aquaticus* oder *aquaticus*-ähnlichen Populationen. Die Verbindung nach Südspanien ist über Sizilien und NW-Afrika, nach Sudanatolien uber Peloponnes und Cypern gegeben. Im Libanon, Kaukasus und in Persien schliessen sich weitere rostbäuchige Formen an und im Ural lebt weithin isoliert *C. c. uralensis*, der zwischen *cinclus* und *aquaticus* ungefahr in der Mitte steht. Dieses Verbreitungsmuster der *Cinclus*-Rassen bzw. der beiden Farbtypen in der westlichen Paläarktis historisch erklaren zu wollen, etwa als Folge postglazialer Arealverschiebungen zweier durch die Eiszeit getrennter und während dieser entstandenen Rassen, scheint mir sehr schwierig, wenn nicht unmöglich zu sein. Es bleibt demnach kaum eine andere Erklarung als die Annahme, dass die dunkelbauchige Form der Wasseramsel an 3 Stellen unabhängig voneinander entstanden ist (*C. c. cinclus* in Nordeuropa, *C. c. pyrenaicus* in N Spanien und *C. c. amphytrion* in N Kleinasien. Ich habe bisher die klare Trennung von dunkel- und rostbäuchigen Populationen betont und insbesondere in Spanien weder bei der einen noch bei der anderen Form Ausnahmen gefunden. Die Populationen der Wasseramsel, insbesondere diejenigen des *aquaticus*-Typs, zeigen aber auch in diesem so auffalligen Merkmal eine erhebliche individuelle Variation, die von Richter (1954), Balat (1961) und Jost (briefl.) (1) untersucht worden ist. Richter fand bei 65 sachsischen Vogeln 9 dunkelbäuchige, Balat bei 79 tschechischen 3 und Jost bei 56 hessischen keine dunkelbäuchige ; mit anderen Worten : unter 200 *C. c. aquaticus* waren 12, d. h. 6 %, vom *cinclus*-Typ. Das bedeutet, dass in den Populationen von *C. c. aquaticus* auch die *cinclus* Mutante « griffbereit » vorliegt, die sich anreichern musste, sobald ein entsprechender Auslesefaktor wirksam wird.

Eine Parallelentwicklung von geographischen Rassen einer Art, wie sie uns als Ergebnis der gleichen auslesenden Faktoren z. B. bei den afrikanischen Lerchen bekannt ist, konnte durchaus auch für die disjunkte Verbreitung von *C. c. cinclus* verantwortlich sein. Dass man bisher (s. o.) eine Korrelation zwischen der Bauchfärbung und klimatischen Faktoren nicht feststellen konnte, ist kein Grund, die Wirkung der Auslese

(1) Herrn Otto Jost, Fulda, der gefangene Wasseramseln jeweils unmittelbar mit Balgen verschiedener Typen verglich, bin ich für Mitteilung dieses unveröffentlichten Materials dankbar.

zu verneinen, denn die Bauchfärbung kann ja genetisch mit einem anderen, der lokalen Auslese unterworfenen Merkmal gekoppelt sein.

RESUME

L'étude des différences biogéographiques entre le Nord et le Sud de la Péninsule ibérique a amené l'auteur à se pencher sur le cas du Cincle, qui dans le Nord de l'Espagne et les Pyrénées se présente sous le type *cinclus* à ventre pâle, et dans le Sud sous le type *aquaticus* à ventre couleur rouille. Les oiseaux appartenant à ces deux formes ne se distinguent pratiquement pas de ceux de Scandinavie (*cinclus*) ou d'Allemagne (*aquaticus*). L'auteur discute la taxonomie de l'espèce, n'adoptant pas l'idée de convergences écologiques mais plutôt celle d'une évolution parallèle des races dans une aire discontinue.

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LE MARTINET PALE DE SOCOTRA
(*APUS PALLIDUS BERLIOZI*)

by S. Dillon Ripley
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During the past winter the U. S. National Museum was so fortunate as to obtain permission for Mr. Alec Forbes-Watson to visit the remote island of Soqotra east of Cape Gardefui (Lat. 12°30' N., Long. 54° E.). The kindness of the Sultan of Qishin and Soqotra in granting this permission is most gratefully acknowledged.

Among the specimens taken by Mr Forbes-Watson is a series of pale swifts. Ogilvie-Grant, *in* Forbes (1903) recorded seeing the species but no one had ever collected it. I wish now to dedicate this swift to my distinguished colleague and friend of many years, on the occasion of this honorary issue of *L'Oiseau et la R. F. O.* :

Apus pallidus Berliozi, new subspecies

Type . ♂ USNM No. 518025, collected by Mr. Alec Forbes-Watson at Kishin, Hagghier Mts., Soqotra, altitude 2200 feet, on 3 May 1964.

Description From *somalicus* (Clarke), 1919, this form differs by being larger and darker, especially on the underparts which are richly blackish rather than fuscus. From *brehmorum* of the western Mediterranean this form differs by being more grayish blackish above and below, less brownish or olive-brown tinted, and by being smaller.

Measurements :

		wing	tail
Berliozi	20 ♂♂	163.5-178 (169.8)	67.5-77 (70.9) mm
	12 ♀♀	155-172 (166.5)	67-70 (68 8)
somalicus	6 ♂♀	152 156 (154.2)	65
Brehmorum	7 ♂♀	164-182 (175.6)	70-80 (77)

Weight : *Berliozi* ♂♂ 34-43 (38.5 ± 4.5) gms ; ♀♀ 37-46 (± 4.5) gm.

Color of soft parts ; iris dark brown, bill black, feet dark pink-brown, or brown-maroon, claws black.

Range : Soqotra Island, western Indian Ocean.

These birds were nearly all in breeding condition, some of the females containing large yolks. They were collected between April 14 and May 9, 1964, most of them from 2000-3800 feet in the mountains. Additionally two males were taken May 17 at sea level one of which was not in breeding condition. Mr. FORBES-WATSON felt that the breeding season presumably was virtually over by mid May. He noted stomach contents as black beetle or flying ant fragments, and in two cases, one at sea level, grasshoppers. On May 18 he watched swifts catching flying termites over Hadibu town at sea level after a rain shower (1).

RESUME

Description d'une nouvelle sous-espèce de Martinet pâle collecté par Alec FORBES-WATSON à Socotora en 1964, et que l'auteur dédie au Professeur BERLIOZ à l'occasion de ce numéro jubilaire.

Depuis cette époque, une nouvelle sous espèce a été décrite par FRIEDMANN en Ouganda, mais celle ci diffère nettement de la race *Berliozi*.

(1) Since writing the above, Dr Herbert FRIEDMANN has described *Apus pallidus kapnodes* (1964), *Los Angeles County Museum Contributions in Science*, N° 83, Dec. 8) from Mt. Moroto, Uganda. Through Dr FRIEDMANN's kindness I have been able to examine six specimens which confirm that *Berliozi* differs significantly from *kapnodes* in larger size (*kapnodes* ; wing ♂ 151-158 [154.2] ; ♀ 151-160 [156]), as well as in plumage pattern. In *kapnodes* the white throat is sullied by an infusion of brownish along the dark shaft and adjacent vanes of the basal and median parts of the featers. This series of *kapnodes* is also far darker below and somewhat darker above than *Berliozi*, with greatly reduced white tips or edgings to the breast and abdomen feathers.

NOTES ON THE SUNBIRD-ASITYS (*NEODREPANIS*)

by Finn SALOMONSEN
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This volume is dedicated to Prof. Jacques BERLIOZ, and I find it appropriate to pay him a hommage by commenting on some exotic and little known birds. Prof. BERLIOZ, whom I have known for almost 40 years, has always been particularly fond of puzzling and exciting species inhabiting remote areas, and he is one of the very few ornithologists of our days that are equally well acquainted with the fauna of all five continents. His experience concerning avian systematics is enormous, and I have always admired his world-wide knowledge as well as his sound and conservative view-points in taxonomic matters. I take this opportunity to thank him for many stimulating discussions in correspondance and in personal interviews in Paris, in Copenhagen and at international conferences abroad.

The bird life of Madagascar is only one of Prof. BERLIOZ' many interests, and he may now recall that many years ago I called a very distinct Malagasy bird after him (*Mentocrex kioloides berliozi*, SALOMONSEN 1934 a, p. 386) as a token of my gratitude for his indefatigable help during my work with the Madagascar avifauna. The following article is only a rather short note, but it deals with some very interesting Malagasy birds.

When *Neodrepanis coruscans* was discovered by CROSSLEY in eastern Madagascar and described by SHARPE in 1875 it was by HARTLAUB (1877, p. 94) called « one of the most interesting ornithological discoveries in recent time ». I still find that it represents a most interesting little group of birds. The genera *Philepitta* and *Neodrepanis*, each with two species, form the endemic Malagasy family of the asitys (*Philepittidae*). Whereas the two *Philepitta* are short-billed fruit-

eating species, the *Neodrepanis* have a long and very thin, strongly curved bill, reminding of that in certain sunbirds, such as *Drepanorhynchus*, honey-eaters such as *Acanthorhynchus* and drepanidids such as *Hemignathus* and others. In all these groups a convergent evolution has taken place, due to similar adaptations.

The *Neodrepanis* have all ear-marks of being nectar-feeding birds, and the scanty information on their life-habits supports this assumption. RAND (1936, p. 472) described how *N. coruscans* continually came to a flowering tree, and during two days sixteen specimens were collected there, and just as many were observed, while in the forest elsewhere only a single individual was recorded. MILNE-EDWARDS and GRANDIDIER (1879, p. 290) mentioned that *N. coruscans* is often found at the balsam species *Impatiens Humblotiana*, which is widely distributed in the rain forests of Eastern Madagascar. This plant has large red blossoms, with the corolla forming a long curved tubular spur, almost of the same size and form as the bill of *Neodrepanis*. This structure is undoubtedly an adaptation to ensure pollination through visits by *Neodrepanis*, and is analogous to similar floral modifications in the endemic ornithophilous *Lobeliaceae* of the Hawaiian Islands, which are adapted to pollination by drepanidids. On the colour-plate accompanying my paper on *Neodrepanis* (SALOMONSEN 1934) these birds are seen feeding in a flowering *Impatiens Humblotiana*.

Not only the bill, but even the tongue demonstrates adaptations to nectar-feeding. As shown by AMADON (1951, p. 62) the tongue of *Neodrepanis* is tubular, but differing in structure from that in other nectar-feeding passerines, while the tongue of *Philepitta* is unspecialized.

The remarkable structural differences between *Philepitta* and *Neodrepanis* illustrate an adaptive radiation in this family which, it is true, is by far not so striking as the well-known cases in *Geospizinae*, *Drepanididae* and *Vangidae*, but nevertheless is an interesting phenomenon. *Neodrepanis* has been able to utilize an ecological niche which was virtually unoccupied in Madagascar. Only the long-billed *Cinnyris notatus* may occasionally compete with it during feeding in flowers, as noticed already by RAND (*loc. cit.*), while *Cinnyris sovimanga* and *Zosterops madaraspatanus* have much too short bills.

The English vernacular of *Neodrepanis* was formerly « Wattled Sunbird », but when it was discovered by AMADON (1951, p. 59) that these birds belonged to the *Philepittidae* the name was changed to « False Sunbird » (*e. g.* by GILLIARD 1958, p. 291, and RAND 1964, p. 66), following AMADON's French designation « Pseudo-Souimanga ». It appears to me, however, to be more appropriate to call these birds « Sunbird-Asitys », in acknowledgement of their position as members of the family of asitys. It is peculiar that the close relationship between *Neodrepanis* and *Philepitta* was discovered so late, although a number of expert ornithologists, such as SHARPE, HARTLAUB, GRANDIDIER and SHELLEY have studied these birds. Some of these students, however, had a feeling that the two genera were related, this holding good especially of SHELLEY.

The similarities between *Neodrepanis* and *Philepitta* include the following characters : (1) Plumage coloration, particularly noticeable in males of *Philepitta schlegeli* and *Neodrepanis hypoxantha*, which both have the under-parts uniform yellow of about the same shade ; (2) Sexual dimorphism, with greenish plumage in females ; (3) Very short tail, constituting about half the wing-length (in sunbirds usually at least two-thirds the wing-length) ; (4) Presence of orbital wattles in adult males (not developed in sunbirds) ; (5) Extremely long first (outer) primary, extending almost to tip of wing (in sunbirds constantly shorter than secondaries). To this come the important and decisive family characters, demonstrated by AMADON (*loc. cit.*) : (6) Mesomyodian syrinx, (7) Taxaspidian scutellation on tarsus, (8) Vestigial hyporhachis (well-developed in sunbirds).

When I studied these birds it did not appear to me, admittedly, that *Neodrepanis* and *Philepitta* were related, even though in my paper (SALOMONSEN 1934, p. 2) I pointed out and discussed the extraordinary length of the first primary in *Neodrepanis*, which was unprecedented in the suborder *Oscines*. It may be some excuse for me that I was mainly concerned with the study of the moult and sequence of plumages, in which respect the situation is quite extraordinary. The moult is extremely similar in *Neodrepanis* and the sunbirds, while it differs strikingly in *Philepitta*. The members of the latter genus has only one annual, postnuptial moult, while *Neodrepanis* has two annual moults, developing a special off-

season (eclipse) plumage, which is the case also in most sun birds. The parallelism goes so far that even the extent of the partial, praenuptial moult in *Neodrepanis* equals that in certain sunbirds. This is a peculiar situation.

During a visit to the British Museum (Nat. Hist.) I studied the moult of *Neodrepanis coruscans*, and found that the similarity with that in the Mascarene sunbirds, especially *Cinnyris sovimanga*, was striking. No specimens of *N. coruscans* from the period October-March were examined, but the September birds were in breeding plumage and had big and swollen testes. The breeding-time, therefore, is undoubtedly September-November, as it is also in *Cinnyris sovimanga*, and for that matter in the greater part of the birds inhabiting Eastern Madagascar.

I have seen no nestlings (in natal plumage) of *N. coruscans*, but there are many immature birds (in juvenal plumage) in the collection of the British Museum. The juvenile males and females are indistinguishable, and I also failed to see any difference between the juvenile birds and the adult females. The juvenal plumage is kept to May-July, when it is replaced through a complete postjuvenal moult by the first nuptial plumage, in which the birds very likely already breed. This corresponds with the situation in *Cinnyris notatus* in which species the juvenal plumage is shed through a complete postjuvenal moult in May-July. *Cinnyris sovimanga* has, on the other hand, a complete postnatal moult, and the juvenile birds are quite like the adult birds in off-season dress.

The adult males of *N. coruscans* have, as already mentioned, alternating off season and nuptial (breeding) plumages. This situation is present also in most sunbirds, and in the Mascarene species I have found it in all except *Cinnyris notatus* (and its subspecies) and *C. dussumieri*, which have only one moult. Adult specimens of *N. coruscans* collected in April are still in full off season plumage, but already some May birds (males) are in breeding plumage, but some moult later, as shown by a specimen captured in August and still in its prenuptial moult. This corresponds with the condition in *Cinnyris sovimanga*, of which a large series was examined. In this species the prenuptial moult extends from June to August.

Neodrepanis, just as all other passerine birds, has a com-

plete postnuptial moult, including wings and tail, but owing to lack of material from October-March I have seen no specimens in postnuptial moult. In the Mascarene sunbirds I have found the following periods for the complete postnuptial moult : *C. sovimanga* : January-March, *C. coquerelli*, *C. aldabrensis*, *C. abbotti* and *C. dussumieri* : March-April. As the time for the partial prenuptial moult of *Neodrepanis* corresponds with that in *C. sovimanga* it is probable that its complete postnuptial moult takes place in January-March, just as in *C. sovimanga*, and this would signify that *Neodrepanis* kept its off-season plumage for 4-5 months, from January-March to May-August.

A very interesting specimen of *N. coruscans* is a male in full prenuptial moult, captured on the 23. August 1930 at Andapa. The moult is incomplete, and the feathers are renewed in the following regions : Head, nape, hindneck, mantle, back, scapulars, ear coverts, cheeks, chin, throat and upper breast, but *not* on rump, lower breast, abdomen, wing-coverts and upper and under tail-coverts and of course not remiges and rectrices. The rump, the tail-feathers and the smaller wing-coverts are already glossy in the off-season dress, and through the prenuptial moult also the front, cheeks, neck, mantle, back and scapulars attain metallic glossy feathers. It is noteworthy, however, that the new feathers on chin, throat and upper breast are olive-yellow with greyish bases without the least metallic gloss, *i. e.* exactly as in the off-season plumage. Consequently *Neodrepanis* moults its feathers on chin, throat and upper breast twice annually, but the two feather generations are identical in coloration. In *C. sovimanga* the partial prenuptial moult comprises the same regions as in *Neodrepanis*, but the new feathers on throat and breast are bright metallic, while in the off-season dress they are yellowish with blackish bases, of the same colour as the feathers of the back. Just as in *Neodrepanis* the rump feathers in *C. sovimanga* are not renewed during the prenuptial moult, but contrary to the glossy-rumped *Neodrepanis* they are brownish grey without gloss and remain so in the breeding plumage.

The remarkable similarity in moult between *Neodrepanis* and the sunbirds is not easy to explain. We know now that it does not express any actual relationship, but is due to a parallel development. It is difficult to understand, however,

how this parallelism could be the result of similar adaptations, when bearing in mind that the sunbirds, which all have very similar life habits, demonstrate a considerable variation in their moulting schemes.

The above-mentioned specimen of *Neodrepanis coruscans* (from the 23. August) demonstrates very well the prenuptial development of the orbital wattles. In the off-season dress the wattles are obliterated and the skin is completely feathered. In the specimen in question most of the off season feathers are shed, but not renewed, with the result that the orbital region, 2-3 mm in front of the eye and 4-5 mm behind the eye, is almost bare, supplied only with scattered and very worn feathers belonging to the off-season dress. At the same time the skin has begun to arch backwards (caudally), and a lobe of about 1.5 mm in length has already developed. At a later stage the lobes grow still larger, and in the breeding time the bare skin extends up to 5 mm above the eye and twice as much behind the eye. After the breeding time the lobes disappear and the orbital region is again supplied with feathers.

Some words should be added about the species *Neodrepanis hypoxantha*, which differs from *N. coruscans* by having, in both sexes, uniform bright canary-yellow under parts (slightly lighter in female) and by having horn-brown (not black) bill, which is distinctly shorter and finer and not so curved as in *coruscans*, further, by having, in adult males, a much stronger emargination on the first (outer) primary, which has the tip very strongly attenuated, and, finally, by possessing a loral extension of the orbital wattle.

This distinct species is much rarer than *N. coruscans* and, apparently, has a much more restricted range. Only very few specimens are known. I described this species (SALOMONSEN 1933, p. 182) on the basis of two specimens (adult male in off season plumage and adult female) in the British Museum, collected by the Rev. W. Dean COWAN in July 1881 in the forests east of Tananarive. For some years these two specimens were the only ones known, but in 1937 STRESEMANN announced that there were two specimens (adult male in breeding plumage and adult female) in the Zoological Museum in Berlin and one more adult male in another German museum, all three specimens collected in November 1880 by J. M. HILDEBRANDT at a locality called Andrangoloaka,

situated somewhat east of Antsirabé on the slopes of the plateau in central eastern Madagascar (SIRESEMANN 1937, p. 135). Subsequently, WETMORE (1953, p. 91) published a further record, an adult male in breeding plumage, kept in U. S. National Museum in Washington, collected by the Rev. James WILLS in October-November 1895 in « E Imerina », which is the name of the plateau around Tananarive, now almost devoid of forest.

Until this period all specimens known, a total of six, were collected on the mountain slopes of the central eastern parts of Madagascar, and in these areas the forest has been virtually destroyed. More recent expeditions, such as the great Mission Zoologique Franco-Anglo-Américaine à Madagascar 1929-31, did not meet with N. *hypoxantha* at all, with the result that this species was generally supposed to be extinct, *e.g.* by the present author (SALOMONSEN 1934, p. 6), STRESEMANN (1937, p. 136) and WETMORE (1953, p. 91), and even as recently as 1958 by GILLIARD (1958, p. 291). In the same year, however, GREENWAY (1958, p. 28) mentioned a specimen (male) collected in the Sianaka forest the 25 February 1925 and now in the Museum of Comparative Zoology in Cambridge, Massachusetts. The specimen was purchased from the dealer Karl FRITSCHE in Bremerhaven, Germany, who in those years sold large numbers of Madagascar skins, collected in the Sianaka forest. This forest, situated between Fanovana and Lac Alaotra, is very extensive and not much destroyed, and GREENWAY concludes that « *N. hypoxantha* will be found again ». This prediction has come true, a still more recently collected specimen has turned up. During a visit to the British Museum a few years ago I found in the collection an adult male in off season plumage of *N. hypoxantha*, misidentified as *N. coruscans*, collected in August 1929 in the « Grande forêt de l'Est (Fito) » by the well-known French forester and ornithologist L. LAVAUDEN. The specimen is catalogued under the number 1939. 12. 9. 588. Fito is a locality situated within the great forest of Sianaka. Although I have been informed that the destruction of the Sianaka forest has strongly increased in recent years I am quite certain that *N. hypoxantha* still survives in these areas, which is the main stronghold of many other rare species, such as *Hartertula flavoviridis*, *Dromaeocercus brunneus*, *Oxylabes cinereiceps*, *Oxylabes xanthophrys* and *Ber-*

nierta tenebrosa, and probably also of the very rare *Newtonia fanovanae*, of which the type specimen still is the only one known.

I can add that I have located one more specimen of *N. hypoxantha* collected by J. M. HILDEBRANDT. It belongs to the collection of the late Count O. ZEDLITZ, and is now kept in the Riksmuseum, Stockholm. The specimen is an adult male in breeding plumage, collected in November 1880 at Andrangoloaka, just as the three other HILDEBRANDT specimens.

Of the nine known specimens of *Neodrepanis hypoxantha* seven are males, and there are information about the plumage in six of these. Four males collected in October-November are in the breeding plumage, and two collected in July-August are in the off-season plumage. In the July specimen (the type of the species) a few feathers of the breeding plumage have already appeared on the mantle. Although the material is scanty it tends to show that the sequence of plumages in the adult male of *N. hypoxantha* is similar to that in *N. coruscans*.

RESUME

La famille malgache des Philepittidés est un exemple de radiation adaptative due, en grande partie, aux différences dans le comportement alimentaire des espèces appartenant aux genres *Philepitta* et *Neodrepanis*. La mue et les séquences de plumage de ces deux genres sont ici décrites. Les *Neodrepanis*, qui sont nectarivores, ressemblent superficiellement aux Souis-Mangas (Nectariniidés). Ils ont une mue qui, dans le détail, ressemble également beaucoup à celle des Souis-Mangas. Pourtant, les deux groupes sont sans relation et leur ressemblance est due à une simple évolution parallèle.

La position systématique du rare *Neodrepanis hypoxantha* fait l'objet d'une discussion. Cette espèce a été considérée comme éteinte, mais des specimens ont été collectés en 1925 et 1929 dans la forêt de Sianaka. Aussi l'auteur en conclut il que l'espèce existe encore dans cette région où la forêt n'a pas été détruite.

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MOLECULAR SYSTEMATICS : NEW TECHNIQUES APPLIED TO OLD PROBLEMS

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The search for evidence of taxonomic relationships has prompted systematists to investigate many aspects of the form and function of birds. NITZSCH (1840) produced one of the first broad comparative studies with his atlas of pterylography and MÜLLER (1847) examined the structure of the syrinx in many groups of birds. In 1867 T. H. HUXLEY developed a classification based upon the palatal bones and a few years later GARROD made recommendations for classifying birds on the basis of the carotid arteries (1873 a) and the arrangement of the pelvic muscles (1873 b ; 1874). GARROD also (1875) found useful information in the flexor tendons and GADOW (1899) reported on the taxonomic value of the intestinal convolutions of birds. FORBES, FURBRINGER, BEDDARD, PYCRAFT, SHUFELDT and others studied various anatomical characters including the structure of the toes, the condition of the fifth secondary (eutaxy vs diastataxy), the shape of the nostrils (schizorhinal vs holorhinal), the presence or absence of a septum between the nares, the arrangement of scutes on the tarsal envelope, the variations in the sternum and tongue, the size of the intestinal caeca, the development and feathering of the uropygial gland, the condition of the aftershaft and the thigh artery and the number of cervical vertebrae, remiges, rectrices and many other structures. In more recent years some of these have been re-examined and additional anatomical and functional characters have been investigated. HUDSON (1937, 1948) has added to the work on pelvic muscles, GLENNY (1955) has studied the carotids and other arteries in the region of the heart, BEECHER (1950) compared the jaw muscles of the passerines, TORDOFF (1954) considered certain aspects of the skull of the Fringillidae

and AMES (*in press*) has studied the passerine syrinx. STALLCUP (1954 ; 1961) and MAINARDI (1963) have used serology and several studies of behavior have made taxonomic recommendations. The parasites of birds have been used as evidence of avian relationships by CLAY (*e.g.* 1957) and TIMMERMANN (1963), the wing molt by STRESEMANN (1963) and the morphology of avian sperm by McFARLANE (1963). MAYR (1959) has also reviewed this history and has cited additional examples.

Each new study has been presented with the hope, and sometimes with the conviction, that here at long last was the key to the classification of birds. But the optimism at the beginning of each new investigation gradually changes into doubt as further data accumulate. Every character eventually is found to be adaptive, to be subject to convergence and to present inconsistencies in comparison with other characters. The difficulties confronting avian systematists were graphically portrayed in 1959 by STRESEMANN who concluded that the efforts of the past 200 years had failed to provide us with trustworthy information on the relationships of the higher categories of birds. Nevertheless each new set of data has provided us with additional information and it is certainly true that our present understanding of avian relationships is much better than it was 200 years ago. It is also true, as STRESEMANN emphasized, that the relationships of the higher categories of birds are still quite uncertain. So obscure is their phylogenetic history and so uncertain is our knowledge of their genetic relatedness that the orders of birds might almost as well be considered the results of separate acts of special creation as the products of a monophyletic ancestry. The fossil record is unlikely to fill in more than a few of the many gaps for avian fossils are not readily preserved and hence will never be numerous.

In spite of STRESEMANN's justified pessimism the search continues. BOCK (1960) showed that the palatine process of the premaxilla « has little value in showing relationships between families of passerine birds » and thereby helped to free us from certain misconceptions. STRESEMANN, apparently unconvinced by his own argument, continues to produce perceptive studies of taxonomic value on wing molt patterns (1963).

Although we have been repeatedly disillusioned we remain

convinced that the evidence exists if only we can learn how to expose it and to interpret it. The search is for new data to supplement the old and our loss of innocent faith has been accompanied by an increasing sophistication in both theory and techniques.

There is, in systematics, only one basic technique, that of *comparison*. Because comparisons between whole organisms present insuperable difficulties it is customary, in fact necessary, to compare *characters*. For characters to be comparable they must be the products of homologous genes. This requirement restricts us to comparisons between closely related organisms if we are to avoid the hazards of convergent evolution because most aspects of gross morphology are the products of many genes some of which may not be homologous in different organisms. To circumvent these difficulties systematists have constantly searched for « conservative » characters which would preserve evidence of evolutionary history in spite of adaptive changes and convergent similarities. Within the past twenty years the development of « molecular biology » has opened up new possibilities for the comparison of morphological characters clearly determined by homologous genes. Several new techniques for measuring and comparing morphological characters at the molecular level of structure have become routine and are available for application to systematics. More complicated techniques which promise much for the future but are not yet ready for general use are being developed.

In previous papers (SIBLEY, 1960 ; 1962 ; 1964) I have presented the rationale behind the comparative study of homologous proteins as a source of data for classification. It may be assumed that all biologists today are aware that the linear sequence of amino acids in a protein chain is a translation of a corresponding sequence of genetic coding units in a segment of DNA. Thus a protein molecule is the direct phenotypic expression of a gene. The fact that the genetic code has, so far, proved to be universal provides us for the first time with a common unit of genetic currency, the coding unit of DNA. Because the sequence of genetic coding units is expressed as the sequence of amino acids at the protein level it is clear that comparisons among homologous proteins are essentially the same as comparisons of the genes themselves. It is also apparent that the ideal basis for comparisons would

be the complete amino acid sequences of homologous proteins. Unfortunately, the determination of complete sequences is still extremely tedious and is not yet practical for comparisons among hundreds of species. However, there are several techniques which can be used in comparative studies of the properties of proteins. Electrophoresis is one such technique which has been used extensively to characterize such protein systems as mammalian blood serum (JOHNSON and WICKS, 1959), avian egg white (SIBLEY, 1960), the plasma proteins of amphibians and reptiles (DESSAUER and FOX, 1956) and the muscle proteins and hemoglobins of fishes (TSUYUKI, ROBERTS and VANSTONE, 1965). Electrophoresis is defined as « the movement of charged particles suspended in a liquid under the influence of an applied electric field ». The speed of migration of a protein molecule depends primarily upon its net electrical charge, perhaps to a slight extent upon the distribution of the charged amino acids and, in such media as starch gel, upon the size and possibly the shape of the molecule. The various proteins in a mixture like egg white move at different speeds and thus they separate during electrophoretic analysis. By carrying out the separation in a supporting medium such as filter paper or starch gel it is possible to produce a dyed pattern indicating the positions of the different proteins after a standard period of time. The patterns may then be compared and differences and similarities among species noted and assessed.

Electrophoresis is a useful and powerful tool but its limitations should never be forgotten. Two proteins with different amino acid sequences can show identical electrophoretic behavior and two proteins differing by but a single amino acid may show quite different behavior. One safeguard against erroneous interpretations due to such problems is to use electrophoretic comparisons only for protein systems such as blood serum and egg white which contain an array of many different proteins. The complex patterns produced are likely to be completely identical only if they are derived from genetically very similar organisms. Another safeguard is to make separate comparisons using different buffer systems since the electrophoretic behavior of a protein varies with the pH of the environment.

During the past ten years we have used electrophoretic techniques to compare the egg white proteins of nearly

2000 species of birds. We have studied the egg white proteins of all of the 27 orders and of 146 of the 170 living families recognized by WETMORE (1960). In most cases the protein data support the present classification. The Anatidae and the Galliformes prove to be closely-knit groups as was already clear from the evidence of morphology and hybridization. Similarly the Charadriiformes prove to be a natural unit and the New World nine-primaried oscines also prove to be as similar in their proteins as in their gross morphology.

The departures from strict agreement also provide some interesting aspects. The egg white proteins suggest that *Struthio* and the Casuariiformes are related and that *Rhea* may also be part of the same ancient but monophyletic assemblage

Gavia may be closer to the Laridae than to any other living group and the Alcidae are clearly allied to the other Charadriiformes, not to the penguins as was suggested by VERHEYEN (1958). The Pelecaniformes are remarkably heterogeneous and the protein evidence raises a strong suspicion that this group may be polyphyletic. The Ciconiiformes however do show a constant pattern even though there is considerable variation. The flamingos are apparently closer to the herons than to the ducks.

The Coraciiformes are also probably polyphyletic for the rollers (*e. g. Eurystomus*) are remarkably unlike *Merops*, *Momotus*, *Todus* and *Megaceryle*.

Among the passerines the Alaudidae, Hirundinidae, Corvidae and most of the nine-primaried oscines stand out as uniform, natural units. The egg white patterns of the Parulidae, Icteridae, Thraupidae (including *Tersina*) and Emberizinae are essentially indistinguishable. The Carduelidae are close to this assemblage and the Drepanidinae may well be considered to be carduelid. *Fringilla* itself differs sufficiently to present a question about its affinities as has been recognized by MAYR, ANDREW and HINDE (1956). The Ploceidae and Estrildidae are easily separable from one another and the latter are distinct from the Carduelidae.

Complete data supporting these general remarks, and further data and discussion will be found in SIBLEY (1960 ; *in prep.*) and SIBLEY and AHLQUIST (*in prep.*).

We have also studied the electrophoretic behavior of the hemoglobin of about 800 species representing all but three

of the 27 orders of WETMORE (1960). Most groups of birds have two hemoglobins, a few have one, several have three and a few have four. The oscines are impressively uniform, all have two hemoglobins and the evidence obtained by examination of their behavior under different conditions of pH indicates a high degree of similarity throughout. The sub-oscines also have two hemoglobins which are somewhat more heterogeneous in mobility.

The hemoglobins of the non-passerines tend, in general, to corroborate the evidence obtained from the egg white proteins. The ostrich and emu have similar hemoglobins and *Rhea*, although showing some differences, is similar to them.

The Podicipediformes, Sphenisciformes, Procellariiformes, Charadriiformes and Gruiformes all have three hemoglobins and, in general, they also show similarities in their egg white patterns. This suggests an ancient relationship which is already generally assumed by systematists.

The birds of prey provide some fascinating problems. The Cathartidae have four hemoglobins, the Accipitridae, *Pandion* and *Sagittarius* show three and the Falconidae two. It is especially intriguing to find that *Falco* is more like *Tyto* than it is like any of the other diurnal birds of prey ! This of course would agree with the suggestions of a falcon-owl relationship made by STARCK and BARNIKOL (1954), STARCK (1959) and VOIPIO (1955). In his classification BERLIOZ (1950) placed the Strigiformes and Falconiformes close to one another.

These are but a few of the results to date from the hemoglobin studies. Complete data and discussion may be found in SIBLEY and BRUSH (*in prep.*).

In addition to the studies on egg white and hemoglobin we have also completed an analysis of the eye lens proteins of several hundred species using starch gel electrophoresis. RABAEY (1959) and GYSELS (1964 ; 1965) have published extensively on their studies of lens proteins using agar gel electrophoresis. Our results will be presented elsewhere (SIBLEY and BRUSH, *in prep.*).

Most of the taxonomic studies to date have been based upon intact proteins or protein systems such as egg white, blood serum, eye lens proteins or hemoglobin. However, because the *sequence* of amino acids in a protein is the expression of a segment of the genetic code it is clear that a

technique that will provide an index to that sequence should be a useful method for systematics. The simplest approach to the next level of structural complexity is to break the protein chain at specific points to produce a set of homologous fragments or « peptides » For example, the enzyme trypsin will split a protein chain only at the positions occupied by the amino acids arginine and lysine. This is analogous to dividing a sentence into phrases by cutting it at each « a » and each « l ») The resulting peptides may then be characterized by one of several techniques and the behavior of homologous peptides can be compared. One method is to separate the peptides by ion-exchange chromatography and to compare the complex curves which can be produced using automatic instrumentation. I have reported on one such study which demonstrated that even closely related species possess differences in the structure of such proteins as ovalbumin and ovomucoid (SIBLEY, 1964). A study of the tryptic peptides of the ovalbumins of several species of pigeons (Columbidae) has been completed by CORBIN (1965), using two-dimensional thin-layer chromatography and electrophoresis. This technique has been described by RITSCHARD 1964). In the near future we expect to begin a comparative study of the tryptic peptides of avian hemoglobins

At the next level of complexity, that of peptide composition, the amount of work involved increases sharply but the information is also greatly amplified HILL and BUETTNER-JANUSCH (1965) have demonstrated the value of such studies in their interesting work on the hemoglobins of primates.

Further improvements in automatic instrumentation will eventually speed up the processes involved but until they do it will be necessary to restrict this technique to studies involving few species.

To determine the complete sequence of the amino acids in even a small protein of less than 100 residues is a slow and difficult process Several different peptide cleavages must be made and compositional analyses must be carried out on all the peptides to provide the data required for the determination of the sequence. So far the only taxonomically significant studies at this level are those of SMITH and MARGOLIASH 1964), on cytochrome c and these involve only eleven species and relate to very general problems.

Ever since it became certain that genetic information was

encoded in the linear sequence of the nucleotides in DNA it has been obvious that an index to that sequence would be the ultimate systematic technique. We are still a long way from being able to compare the actual nucleotide sequences of homologous DNA segments but the development of the technique of « DNA hybridization » promises to provide an index to the genetic relatedness of any two species. This technique, which has been made applicable to the systematics of higher organisms by the agar embedding method of HOYER, MCCARTHY and BOLTON (1964), provides an index to the base pair complementarity of the two DNA's to be compared. It is thus an index to the degree of similarity between the total genomes of the two species being compared.

DNA hybridization promises much for the future but it is a relatively difficult procedure which requires specialized instruments. Avian DNA is easily obtained from the nuclei of the red blood cells and we now have a collection of purified DNA specimens from over 500 species representing all but three of Wetmore's 27 orders. This material will be utilized in systematic studies over the next few years.

What then, in general, has been accomplished in the past 10 years in this field and what may we expect in the future ? Old techniques have been refined and new ones have appeared frequently. Better instruments are constantly becoming available and yet much better ones are still needed. Collections of proteins and DNA, representing many groups of organisms, have been accumulated, although many more specimens, especially or fresh material, are needed.

So far the results, in terms of new and more accurate classifications, are not impressive. This is due partly to the limited collections available and partly to the fact that most of the available techniques are actually relatively crude. However these problems will be overcome as collections grow and techniques improve. The basic validity of the theoretical framework is unchallenged and seems well-founded. This means that the important discoveries and contributions of the molecular approach to systematics still lie in the future and hence an attempt to look ahead is justified.

It is reasonable to expect that the number of studies using molecular techniques will increase and additional groups of organisms will be investigated. Automatic instruments of great sophistication will be developed for use in molecular

biology and will be applied to comparative studies. They will be costly and they will require skilled technicians to operate them but they will provide vast amounts of new data.

The collection and preservation of specimens of proteins and DNA must be greatly improved and expanded. Special expeditions equipped to preserve material in the deep cold of liquid nitrogen will be required.

Molecular systematists must be trained in classical taxonomy — they must in fact *be* classical taxonomists — and they must be familiar with the organisms they are studying as living plants and animals. In addition they should be at least reasonably familiar with the concepts and techniques of molecular biology and biochemistry.

Finally, let it be clearly understood that the application of the methods of molecular biology to systematics does not insure the solution of all of our problems. The new techniques provide new kinds of calipers which can measure previously unavailable characters but the interpretation of the data still requires a systematist who knows, appreciates and understands the other available information about the group of organisms he is studying. The molecular data are enormously exciting, and hold great promise for future discoveries, but they must be viewed as additions to, not substitutes for, what is already known about the genetic relationships and evolutionary history of plants and animals.

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RESUME

Leur structure etant liée à celle de l'ADN, les protéines peuvent être considérées comme l'expression phénotypique des gènes. Leur comparaison s'avère donc susceptible d'ap-

porter des éléments valables du point de vue systématique. Ainsi s'est développée l'étude des protéines par électrophorèse (étude des déplacements sous l'action d'un champ électrique de particules électriquement chargées en suspension dans un liquide). Pour minimiser les sources d'erreur, outre que l'on renouvelle les expériences à pH différent, on utilise des matériaux tels que le sérum du sang ou l'albumen de l'œuf qui contiennent un assortiment varié de protéines. Les schémas de la répartition de ces dernières à l'électrophorèse ne seront identiques que si elles dérivent d'organismes génétiquement très proches. Un résumé est donné des résultats obtenus par l'auteur et d'autres chercheurs à la suite d'études des protéines de l'albumen de l'œuf, de l'hémoglobine et du cristallin.

Afin de serrer davantage le problème des relations entre espèces, on peut analyser par un procédé chromatographique les divers peptides obtenus par fractionnement des chaînes protéiques à l'aide d'enzymes appropriés permettant de connaître à quels niveaux se produisent les ruptures.

Il apparaît même possible d'envisager des études taxonomiques fondées sur la séquence complète des amino acides composant les protéines. Plus encore, des comparaisons des ADN vont être entreprises, le matériel étant actuellement recueilli.

Indéniablement, les résultats obtenus par la biologie moléculaire et la biochimie viennent utilement compléter, sans prétendre les remplacer, les informations recueillies jusqu'à présent par la systématique classique.

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DIE MAUSER DES KAMPFLÄUFERS
PHILOMACHUS PUGNAX

von Erwin STRESEMANN
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(Oxford 1934)

und Vesta STRESEMANN

Die Geschlechter unterscheiden sich beim Kampfläufer in vieler Hinsicht weit mehr als bei allen anderen Limicolen. Jedermann weiss, dass das Männchen viel grösser ist als das Weibchen, dass nur das Männchen ein sehr auffälliges « Hochzeitskleid » trägt und ferner, dass es sich nach der Copula weder um die von ihm befruchteten Weibchen noch um die Nachkommenschaft kümmert.

Unbekannt aber war bis vor kurzem, dass sich die Geschlechtsunterschiede auch auf den Zeitpunkt und den Verlauf des Gefiederwechsels erstrecken.

Erst Frau Elisabeth KOZLOWA (1956, 1962) hat die Mauser von *Philomachus* gründlich untersucht und dabei entdeckt, dass dieser Vogel den grössten Teil seiner Körperfedern zwischen zwei Brutcyclen nicht wie bis dahin angenommen worden war zweimal, sondern dreimal erneuert. Das hat sie gefolgert aus dem sorgfältigen Studium vieler Bälge des Zoologischen Instituts zu Leningrad, die im Raum der Sowjet-Union in den Monaten März bis Anfang Oktober gesammelt worden waren. Was für Veränderungen das Gefieder im Winterquartier durchmacht, konnte Frau Kozlowa nur vermuten.

Kollegiale Hilfsbereitschaft hat es uns ermöglicht, diese Lücke zu schliessen und von der Mauser des Kampfläufers eine deutlichere Vorstellung zu gewinnen. Wir untersuchten nahezu 90 im Zustand der Mauser gesammelte Bälge, die sich auf die Monate Juli bis Mai verteilen. Darunter sind gegen 50 Exemplare aus dem afrikanischen Winterquartier ; sie wurden uns für unseren Zweck von den Verwaltern der Museen in Bulawayo und Durban freundlichst zugesandt.

L'Oiseau et R.F.O., V. 35, 1965, n° spécial.

Es ist uns eine grosse Freude, die wesentlichsten Ergebnisse unserer *Philomachus*-Studien unserem langjährigen Freund Jaques Berlioz bekanntgeben zu können, bevor unsere Monographie der Vogelmauser abgeschlossen ist, worin das Thema ausführlich behandelt werden wird.

Das Brutgebiet des Kampfläufers nimmt den ganzen Norden des eurasiatischen Festlandes ein und reicht bis in die arktische Tundra. Die meisten Populationen, zum Teil auch die ostsibirischen, überwintern in Afrika, wo sich besonders viele Kampfläufer von September bis März südlich des Aequators, bis hinab zur Kap-Provinz, aufhalten. Im zeitigen Frühjahr wandern sie wieder zu den Brutarealen. Die Vortrupps der Heimkehrer bestehen vorwiegend aus Männchen. Sie pflegen, bald von der Hauptmasse beider Geschlechter gefolgt, in Holland in der zweiten Marzhälfte, in Ostpreussen gegen Mitte April, in der arktischen Tundra aber erst gegen Ende Mai oder noch später zu erscheinen. Am Südrand des Brutareals werden die Eier im Mai oder in der ersten Juni-Hälfte, in der Arktis von Mitte Juni an gelegt.

Die adulten Männchen verlassen das engere Nistareal in Deutschland spätestens in der zweiten Junihälfte, die Weibchen verbleiben dort, bis ihre Jungen fliegen können

Mauser der adulten Männchen

Sehr bald nachdem die Männchen aufgehört haben die Turnierplätze aufzusuchen (in Deutschland gegen Mitte Juni) streichen sie gesellig umher. Sie beginnen dabei ihren Kopfschmuck und die langen Kragenfedern zu verlieren und auch am übrigen Körper das Brutkleid gegen ein schlichtes Reisekleid (das postnuptiale Schlichtkleid) zu vertauschen. Aber diese der Wanderung nach Afrika vorausgehende Mauser erstreckt sich nicht nur auf alle Körperfedern, sondern auch auf alle Schwung- und Schwanzfedern oder wenigstens die meisten davon. Ein von uns untersuchtes Männchen aus Holland hat schon am 17. August Flügel und Schwanz völlig erneuert. Andere Männchen unterbrechen die begonnene Flügelmauser, wenn sie in « Zugstimmung » geraten sind, und beenden sie erst in Afrika.

In der afrikanischen Winterherberge wird, wahrscheinlich zwischen November und Februar, das Körpergefieder aber-

mals erneuert. Danach trägt der Vogel das zweite Schlichtkleid (= praenuptiale Kleid). Es kann dem ersten Schlichtkleid entweder gleichen oder etwas kontrastreicher gefärbt sein.

Mit seinem neuen Reisekleid angetan wandert das adulte Männchen im März oder April zur Palaearktis. Erst wenn der Vogel das Ziel seiner Wanderung erreicht hat oder ihm nicht mehr fern ist, verliert er in kurzer Zeit alle Körperfedern (vielleicht ausser denen der hinteren Bauchregion), an deren Stelle die ganz anders gefärbten und an Kopf und Hals auch ganz anders gestalteten Federn des Brutkleides hervorwachsen. Die meisten inneren Armschwingen (die Schirmfedern) und zwei bis drei mittlere Steuerfeder-Paare können schon vor Beginn des Frühjahrszuges in Brutkleid-Färbung fertiggestellt sein ; die etwa verbliebenen Schirmfedern werden auf der Wanderung erneuert (die Schirmfedern mausern dann zum dritten Mal, die Steuerfedern zum zweiten Mal). Das männliche Brutkleid wird also nur zwei Monate lang (in Mittel- und Westeuropa etwa von Mitte April bis Mitte Juni) getragen.

Mauser der adulten Weibchen

Ganz anders als bei den Männchen verläuft die Mauser bei den Weibchen.

Sie beginnen frühestens im Juli, meistens erst im August, das Brutkleid mit dem ersten Schlichtkleid (Postnuptial-Kleid) zu vertauschen, mausern dabei aber nicht das Grossgefieder, sondern wandern Ende August oder im September mit dem alten Flügel und Schwanz nach Afrika. Dort fangen sie frühestens Ende September, in der Regel aber erst im Oktober an, Schwingen und Schwanz zu erneuern, und sind Ende Januar damit fertig. Von Dezember bis Anfang Februar wird das Körpergefieder mitsamt den Schirmfedern abermals erneuert. Aus dieser heftigen Mauser geht ein zweites Schlichtkleid (das Praenuptial Kleid) hervor, das sich vom ersten wenig oder gar nicht unterscheidet. Mitte oder Ende März, also kurz vor dem Aufbruch aus Afrika zur Palaearktis, setzt die dritte Körpermauser ein ; es wachsen nun die kontrastreichen Federn des Brutkleides. In diese Mauser werden einbezogen das mittlere und in der Regel auch das zweite

Wenn das adulte Weibchen am Nistort eintrifft, tragt es also in der Regel schon das fertige Brutkleid.

Mauser der Jungen

oder sogar das dritte Paar der Steuerfedern und wiederum die Schirmfedern.

Die Jungen befinden sich noch im vollständigen Jugendkleid, wenn ihr Zugtrieb erwacht. Sie beginnen das Korpergefieder fast stets erst während der Wanderung oder kurz nach der Ankunft im Winterqaartier zu erneuern. Spätestens Ende November tragen sie in der Regel schon ein vollständiges Schlichtkleid. Dieses wird von Ende Dezember ab ganz allmählich in ein ebenso gefärbtes zweites Schlichtkleid gemausert, wobei auch die fünf Schirmfedern zum zweiten Mal erneuert werden. Unvermausert bleiben im ersten Winter die Handschwingen, die zehn äusseren Armschwingen und alle Steuerfedern.

Wenn die Jungen im Fruhling ihres zweiten Kalenderjahres wieder in der Heimat erscheinen, tragen sie also noch immer ihren ersten Flügel und in der Regel auch noch das zweite Schlichtkleid. Manche jungen Weibchen beginnen während der Wanderung einen Teil des Körpergefieders, eine oder zwei Schirmfedern und das mittlere oder die beiden mittleren Paare der Steuerfedern abzustossen und durch typische Brutkleidfedern zu ersetzen. Wie es sich mit der Körpermauser junger Männchen verhält, wenn sie das Heimatgebiet erreicht haben, vermochten wir nicht genau festzustellen.

Wir vermuten, dass sich viele junge Weibchen in ihrem zweiten Kalenderjahr noch nicht fortpflanzen, und dass die gleichaltrigen Männchen zwar auf den Turnierplätzen erscheinen, aber nur als Zuschauer und ohne dort zu kopulieren. Tischler (1941) hat zu dieser Frage bemerkt : « Nachdem der Frühjahrszug in den letzten Mai-oder Junitagen beendet ist, trifft man auch im Juni fast stets einzelne Kampfläufer am Kinkeimer See (Ostpreussen) an, meist Weibchen, bisweilen sogar in ganzen Flügen. Wahrscheinlich handelt es sich meist um einjährige Vogel. Ein Weibchen vom 8. Juni 1908 hatte ganz unentwickelten Eierstock. »

Die jungen Männchen mausern ihren ersten Flügel im weiteren Brutgebiet, nachdem sie ihn ein Jahr lang getragen

haben, beginnen damit also zur gleichen Zeit wie die adulten Männchen, nämlich im Juli. Die jungen Weibchen mussten, um die Schwungfedern gleichzeitig mit den adulten Weibchen zu erneuern, die weite Entfernung zwischen der nördlichen Palaearktis und dem afrikanischen Winterquartier zum dritten Mal mit ihrem ersten Flügel bewältigen. Das tun sie nicht, sondern sie fangen schon vor der Wanderung, im Juli, mit der Mauser von Flügeln und Schwanz an, die beim Erwachen des Zugtriebes zum grössten Teil, wohl zuweilen sogar ganz beendet ist. Auch das Körpergefieder wird schon zu dieser Zeit erneuert.

RESUME

La mue des Chevaliers combattants adultes diffère, pour les deux sexes, de celle des autres Limicoles par le fait qu'il y en a trois et non une ou deux dans l'année. La séquence est la suivante : Plumage nuptial, 1[er] Plumage neutre (Plumage postnuptial), 2[e] Plumage neutre (Plumage prénuptial), Plumage nuptial.

Le mâle adulte mue les rémiges et les rectrices avant de partir dans ses quartiers d'hiver, contrairement à ce que fait la femelle adulte.

Il ne reprend la livrée nuptiale que lorsqu'il se trouve dans son aire de reproduction ou qu'il en est très rapproché dans sa migration printanière. Au contraire, la femelle adulte revêt le plumage nuptial peu avant la migration prénuptiale alors qu'elle est encore en zone d'hivernage.

Les jeunes des deux sexes reviennent en zone de reproduction au printemps de leur deuxième année et, en même temps que les mâles adultes, y muent les ailes dès juillet, après avoir porté ces plumes pendant un an. Vraisemblablement se reproduisent-ils pour la première fois lorsqu'ils sont dans leur troisième année.

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THE TRANSEQUATORIAL MIGRATION OF THE MANX SHEARWATER (PUFFIN DES ANGLAIS)

by A. Landsborough Thomson
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The main purpose of this paper is to draw attention to some theoretical implications of the transequatorial migration of the nominate subspecies of the Manx Shearwater *Puffinus puffinus* (Brünnich). Important new information about this movement has been acquired in the last dozen years as a result of continued large-scale ringing in the British Isles. These recent data are here presented as a whole, having hitherto been published only in scattered form (Thomson & Leach 1952, 1953 ; Spencer 1955 et seq.) or so far not at all. The records showing transequatorial movement naturally constitute only a small fraction (2.6 per cent. of the total ; 115 712 birds of this species had been ringed under the British national scheme up to the end of 1963, and had yielded 1480 recovery records in all. Less than half of these records, including only two transequatorial recoveries, were available at the time of an analysis, embracing observational data as well, which showed that many of the birds breeding in the southern part of the Irish Sea make feeding visits to the Bay of Biscay during the period March-August (Lockley 1953). A further analysis of limited scope has recently been made (Harris *in press, in litt.*) The present writer is indebted to W. R. P. Bourne (*in litt.*, for some valuable suggestions incorporated here.

The nesting colonies, mainly insular, of *Puffinus puffinus puffinus* are distributed from Iceland and the Faeroe Islands, through the Bristish Isles and north western France (Finistère), to the Atlantic islands from Madeira to the Azores (formerly also Bermuda). In the British area, there is a major breeding concentration on islands in the southern part of the Irish Sea, notably Skokholm (off Pembrokeshire, Wales) ; the species no longer inhabits the Isle of Man, from which it

takes its English name, but there are nesting colonies off the coasts of Ireland and northern Scotland. There are too few records to show whether the more northerly of these British populations behave differently from those in the Irish Sea.

RINGING DATA

In the following table, the records in each category are given in chronological order of recovery dates in successive years of life since that of ringing (irrespective of calendar years). Where an explicit recovery date is not available, the date of report is given in brackets.

TRANSEQUATORIAL AND TRANSOCEANIC RECOVERIES OF MANX SHEARWATERS RINGED IN THE BRITISH ISLES

All ringed on the island of Skokholm, off Pembrokeshire, Wales (51°42'N., 5°16'W), except as otherwise stated :

(B) — ringed on Bardsey Island, Caernarvonshire, Wales ; 52°45'N., 4°48'W.

(C) — ringed on Copeland Island, co. Down, Northern Ireland ; 54°40'N., 5°31'W.

(Sr) — ringed on Skomer, Pembrokeshire, Wales ; 51°44'N., 5°16'W.

Ringed as nestlings (pulli)

RECOVERED IN SOUTHERN HEMISPHERE WITHIN A YEAR

Brit. Mus. (Nat. Hist.)	*Date ringed*	*Date and Place of Recovery*	
EC22980	2.9.62	16.10.62	Caraguatatuba (São Paulo), Brazil ; 23°38'S., 45°32'W.
EC05827	31.8.61	18.10.61	Bay of Guanabara (Rio de Janeiro), Brazil ; c. 22°50'S., 43°12'W.
EC08187	6.9.61	c. 20.10.61	Porto Bello (Santa Caterina), Brazil ; 27°05'S., 48°35'W.
EC52449	27.8.64	24.10.64	Niteroi (Rio de Janeiro), Brazil ; 22°57'S., 43°05'W.
EC56899	7.9.64	24.10.64	nr Itajai (Santa Caterina), Brazil ; 26°50'S., 48°39'W.
AT37976	7.9.55	25.10.55	Santos (São Paulo), Brazil ; 23°58'S., 46°20'W.
EC56797	7.9.64	25.10.64	Camboriu (Santa Caterina), Brazil ; 27°01'S., 48°38'W.

Brit. Mus. (Nat. Hist.)	*Date ringed*		*Date and Place of Recovery*
EC42459	7.9.63	29.10.63	Guaratuba (Parana), Brazil; 25°50'S., 48°36'W.
AT37604	29.8.55	29.10.55	nr. Itanhaem (São Paulo), Brazil; 24°7'S., 46°44'W.
EC56748	9.9.64	2.11.64	nr. Laguna (Santa Caterina), Brazil; 28°15'S., 48°40'W.
EC0568—	27.8.61	(8.11.61)	Bay of Guanabara (Rio de Janeiro), Brazil
3063556	7.9.58	15.11.58	Caraguatatuba (São Paulo), Brazil.
AX4904	10.9.51	20.11.51	Rio de Janeiro, Brazil; 22°55'S., 43°12'W.
AT37929	1.9.55	22.11.55	Rio de Janeiro, Brazil.
AT38100	10.9.55	24.11.55	nr. Itanhaem (São Paulo), Brazil.
EC23580	6.9.62	25.11.62	Bay of Guanabara (Rio de Janeiro), Brazil.
EC22110	30.8.62	25.11.62	Praia de Lagoinha (Santa Caterina), Brazil; 27°48'S., 48°33'W.
EC07739	4.9.61	7.12.61	Itanhaem (São Paulo), Brazil.
EC22608	2.9.62	12.12.62	São José do Norte (Rio Grande do Sul), Brazil; 31°59'S., 52°04'W.
AT36220	25.8.56 (C)	21.12.56	Albardão (Rio Grande do Sul), Brazil; 33°12'S., 52°42'W.
AT24758	23.8.54	—. ? 12 (« late »). 54	nr. Porto Alegre (Rio Grande do Sul), Brazil; 30°30'S., 50°40'W.
EC07527	3.9.61	10. 4.62	nr. Macedo (Buenos-Aires), Argentina; 37°15'S., 57°05'W.

RECOVERED IN SOUTHERN HEMISPHERE IN SUBSEQUENT YEARS

EC23890	11.9.62	29. 9.63	São Sebastião (São Paulo), Brazil; 22°49'S., 44°09'W.
2057768	9.9.60	c. 22.11.61 (long dead)	nr. Venus Bay, South Australia; 33°10'S., 134°28'E.
AT25037	5.9.54	22.11.55	Florianopolis (Santa Caterina I.), Brazil; 27°32'S., 48°30'W.
AT72646	31.8.60 (Sr)	(10. 2.65)	nr. Aracati (Ceará), Brazil, 4°32'S., 37°45'W.

RECOVERED IN NORTH-WESTERN ATLANTIC

AT50166	16.8.57	10. 7.58	off Cape Spear, Newfoundland; 47°32'N., 52°34,W.
AT11692	26.8.52	(30. 6.54)	Bonavista Bay, Newfoundland; 48°42,N., 53°10'W.

Ringed as adults

Brit. Mus. (Nat. Hist.)	*Date ringed*	*Date and Place of Recovery*	
AT48865	19.7.57	22. 9.57	off Cabo Frio (Rio de Janeiro), Brazil ; 23°01'S., 42°02'W.
SS04518	10.4.64 (B)	2.11.64	Santos (São Paulo), Brazil.
AT22469	1.7.54	12. 4.55	off Santa Barbara (Abrolhos), Brazil ; 17°55'S., 38°39'W.
AT16559	2.7.53	12.12.54	Itanhaem (São Paulo), Brazil
AT28960	15.6.55	(12. 2.57)	San Francisco do Sul (Santa Caterina), Brazil ; 26°13'S., 48°36'W.
EC01778	6.4.61	21.10.62	Praia de Lagoinha (Santa Caterina), Brazil.
AT16447	1.7.53	22 10 55	Itanhaem (São Paulo), Brazil.
2051196	30.3 60	c. 24.10.62	Tramandai (Rio Grande do Sul), Brazil ; 29°50'S., 50°03'W.
2052739	28.4.60	23.12 62	Puerto Coronilla (Rocha), Uruguay ; 33°50'S., 53°30'W.
2025165	16.7.59	18.10.62	nr. Joinville (Santa Caterina), Brazil ; 26°18'S., 48°49'W.
AT49733	26.7.57	18.10.62	nr. Joinville (Santa Caterina), Brazil.
AT8306	19.7.47	19.10.52	Cablo San Antonio, Argentina ; c. 36°35'S., 56°50'W.
AT42047	16 8.56	15 11.62	Itapema (Santa Caterina), Brazil ; 27°06'S., 48°36'W.

ANALYSIS

The unique record from South Australia can at present be considered only as exceptional, probably due to the bird being carried downwind from the zone of the westerlies in the southern Atlantic Ocean ; the locality is far outside the otherwise known range of the nominate subspecies, although not very distant from that of the form breeding in New Zealand seas. The two records from Newfoundland relate to the breeding season and presumably to non-breeding birds, but it is mere guesswork whether these had travelled north after « wintering » in South American waters or had performed only a transoceanic movement ; there are also some observational records from off the New England coast. The remaining 38 recovery records, all from South America, may

be treated as a single block of data. They confirm that migra tion to these waters, earlier rather vaguely known from observational data, is a regular phenomenon.

Of these records, 25 are of birds ringed as nestlings ; 21 were recovered in their first year of life, 3 in their second, and one in its fifth The other 13 are of birds ringed as adults at their breeding stations ; they were then of unknown age, and all that need be said is that the recoveries are spread over seven years from that time but fall mainly in the first three There was at one stage a bias against longterm recoveries, because the rings corroded too easily ; but the majority of the birds have been marked with rings of more durable metal.

The monthly incidence of the recoveries in South American waters is as follows :

	Sept. (late)	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
Ringed as pulli								
First year	—	9	8	4	—	—	—	—
Later years	1	—	1	—	—	1	—	1
Ringed as adults	1	6	2	2	—	1	—	1
	2	15	11	6	—	2	—	2

The concentration of the records in the period from late September to the end of December is remarkable - 34, as against 2 in January-March and 2 in April (second week).

The recovery localities are spread along the coasts of Brazil, Uruguay, and Argentina between 4° and 38°S. lat. The most northerly record, the only one north of Cape São Roque, is a February one and the bird was possibly on passage ; the next is from about thirteen degrees further south. There is then a concentration of 30 recoveries between 20° and 30°S. lat. Of the remaining 6, the most southerly are in 36°35'S. lat and 37°15'S. lat. the former in October and the latter, strangely, in April.

The very first record on the list shows how quickly the birds may cross the equatorial belt ; a nestling ringed on 2 September was already in 23°38'S. lat. by 16 October of the same year. (The first young quit their natal burrows on Skokholm early in September, having been abandoned by their parents towards the end of August.) There are South

American recoveries not only of young birds in the first year of life, but of adults in the year of ringing (and presumed breeding); the interval in one such instance was from 19 July to 22 September.

There is a noticeable concentration of records in certain calendar years - the northern winters of 1955-56, 1961-62, and 1964-65, but especially that of 1962-63. In the latter part of 1962 there were no less than 11 South American recoveries, of which 5 were of young birds of the year, and 6 of birds ringed as adults more than a year earlier. Furthermore, 5 (including one young bird) of these 11 were recovered (found dead or dying) in the period 16-24 October, 2 of them together at the same place on the same day and all on the stretch of coast between 23° and 30°S. lat. The information about the circumstances of recovery is in general too meagre to be helpful, but the figures themselves point to local conditions as a cause; there is certainly no correlation with the statistics of birds ringed in different years.

Apart from these positive facts of the ringing data, there is the outstanding negative point that the scarcity of South American recoveries after December is matched by an almost equal scarcity of January and early February recoveries anywhere else. (From observational data it is known that the birds are found in only small numbers in the Bay of Biscay at that time; and a few of them appear at the breeding stations in the Irish Sea before the end of February.) One might conclude that at the beginning of the year, whether the birds are still in the same South American waters or back in European waters, some factor must be militating against the occurrence of recovery records; but no such factor (behaviouristic, environmental, or artificial) is apparent. Alternatively, the majority of the birds may be in some different waters where the chances of recovery are much less - possibly further south in the good feeding area of the upwelling of the Falkland Current, which is not only off an unpopulated coast but in the west wind zone where bodies would tend to be washed offshore (instead of onshore as further north).

DISCUSSION

There are of course many examples of extensive transequatorial migration among both land-birds and sea-birds native

to the higher latitudes of the Northern Hemisphere. The advantages for survival of the species, as against the physiological cost and hazards of long journeys, are nevertheless not fully understood, although some instances seem clearer than others. The benefits, as compared with a shorter migration to lower latitudes in the same hemisphere, are presumably one or more of the following : (*a*) more abundant food of the kind to which the birds are adapted in high northern latitudes ; (*b*) better climatic conditions for obtaining food and for life generally ; and (*c*) longer hours of daylight for obtaining food.

It is also a commonplace that no similarly extensive journeys are made by land birds native to the Southern Hemisphere. This fact is usually considered to reflect the relatively small size and southward extent of the land-masses in the South Temperate Zone, as these provide no real counterpart to the breeding areas available to northern migrants. On the other hand, there are vast southern expanses of ocean, with numerous islands providing breeding places for great colonies of sea-birds ; and correspondingly there are several well-known instances of southern sea-birds (all of them in the Procellariiformes) that regularly visit middle or high northern latitudes while it is summer there. Wilson's Petrel *Oceanites oceanicus* is an outstanding example (Roberts 1940 ; et al.) and likewise certain shearwaters *Puffinus* spp. to be mentioned more fully below (Wynne-Edwards 1925 , Kuroda 1957 ; Palmer et al. 1962 ; Bourne 1963 ; and sources cited for particular species).

It has for long been known that the Greater Shearwater *Puffinus gravis*, breeding in the Tristan da Cunha group in the South Atlantic (c. 37°S. lat.), spends the northern summer in the North Atlantic and reaches as far as the Arctic Circle. The adults desert their young in April, and the young themselves depart in May ; the birds arrive back at the breeding stations in late August or in September (Rowan 1952). Arrival in New England and Newfoundland waters takes place at the end of May or early in June , one ringed as a nestling has been recovered off Newfoundland as early as 15 June in its first year of life. Many of the birds thereafter spread towards the north east, and the species has its period of maximum abundance off the west coast of Europe from mid-August to mid October. The dates show that both passages

through the tropics, from which there are indeed few records, must be rapid ; and also that the movement during the summer in the North Atlantic tends to follow a wide loop in a clockwise direction (VOOUS & VATTEL 1963).

The Short-tailed Shearwater *P. tenuirostris* breeds in the Bass Strait, south-eastern Australia, and migrates to the North Pacific, as shown by observational evidence supported by some ringing results (MARSHALL & SERVENTY 1956 ; SERVENTY 1953, 1956, 1957 et seq. There is a strikingly constant annual cycle ; the parents probably migrate in mid-April, the young leaving late in April or early in May, and sexually mature birds return to the breeding stations late in September. The pattern of the movement has been described as a figure-of-eight, and the northern part of this is a wide clockwise loop. The main concentration in June-August is in an area extending from southern Kamchatka (48°N. lat. and the Aleutian Islands through the Bering Strait at least to Wrangel Island (71°N. lat.). Later in the summer and in early autumn there is much movement down the west coast of North America, although it appears that the participants are predominantly immature birds (of which there is a large population, as breeding does not take place until 6 years of age). Passage through the tropics again appears to be rapid, and a bird ringed as a fledgling was recovered off Shikopu, Japan (33°N. lat.), before the end of May in its natal year.

The Sooty Shearwater *P. griseus* has a wider breeding distribution in the Southern Hemisphere than the other two species just mentioned, and as three main populations are involved the movements are more difficult to interpret. There is nevertheless evidence that migrations performed by many birds of this very abundant species include clockwise loop movements in the northern oceans (BOURNE 1956 ; RICHDALE 1963 ; PHILLIPS 1963 ; WARHAM 1964).

The suggestion, made by various authors, is that in all these southern species the birds perform a peripheral movement round the anticyclones normally present in summer in the centres of northern seas in middle latitudes, being assisted by following winds throughout ; such a movement, in the Northern Hemisphere, is naturally in a clockwise direction. One is thus led to speculate whether the migration of the Manx Shearwater may be a counterpart, with a loop migration in the South Atlantic — counter-clockwise, as with anti

cyclones in the Southern Hemisphere — but of such a route there is no positive evidence whatever, and the species has only once been recorded in southern Africa. There is the further possibility that the pattern as a whole may be a figure-of-eight, as there seems to be some slight observational evidence of a clockwise loop in the North Atlantic, round the anticyclone area of the Azores, in spring.

Another northern species of petrel known to make a transequatorial migration of considerable extent is the Storm Petrel *Hydrobates pelagicus*. The breeding distribution is generally similar to that of the European forms of the Manx Shearwater, but the migration is confined to the eastern side of the Atlantic Ocean and the species does not visit the New World. The chief breeding concentration is probably in the British Isles, but the birds are absent from home waters in winter and also from the northern part of the North Atlantic generally (RANKIN & DUFFEY 1948). At that time, on the other hand, they are abundant off the west coast of Africa. It is possible that the majority remain in tropical waters north of the Equator, but many go further south - even to the Cape of Good Hope and beyond. The evidence is almost entirely observational, but there are two African records of birds ringed as adults in the British Isles - one from off Mauretania in the following January (SPENCER 1957 b), and the other from Cape Province in the following February (unpublished).

Among all birds, so far as is definitely known, the Manx Shearwater is unique in having a regular post-breeding migration from Europe to South America.

RESUME

Analyse des reprises trans équatoriales et trans océaniques de Puffin des Anglais (*Puffinus p. puffinus*) montrant notamment la répartition mensuelle et la distribution géographique de 38 reprises faites au large des côtes de l'Amérique du Sud ; une reprise exceptionnelle dans le Sud de l'Australie et deux autres en été à Terre-Neuve, individus vraisemblablement non nicheurs. Il est fait état du faible nombre d'individus observés en Amérique du Sud, en janvier et février alors

qu'il n'existe toujours aucune certitude de la présence de gros effectifs dans les eaux européennes.

Les migrations trans-équatoriales en genéral et plus particulièrement celles des oiseaux pélagiques sont également commentées. Celle du Puffin des Anglais est comparée à celles de ses congénères du sud ainsi qu'à celles du Pétrel tempête.

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DISTRIBUTION REGIONALE ET ALTITUDINALE DES GENRES *GARRULAX* et *BABAX* ET NOTES SUR LEUR SYSTEMATIQUE

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La révision magistrale du genre *Garrulax* publiée par le Professeur BERLIOZ (1930) a contribué grandement à notre connaissance de la systématique de ce vaste et intéressant groupe des Timaliinés. Elle fut en partie basée sur le grand nombre de spécimens historiques envoyés au Muséum de Paris soit par les missionnaires français dans l'ouest de la Chine, tel que le fameux Père DAVID, soit par des explorateurs français de marque, tel que le Prince Henri d'ORLÉANS. Nombre de formes bien différenciées furent décrites d'après ce matériel par VERREAUX, OUSTALET, ou le Père DAVID lui-même. Leurs types sont à Paris.

Antérieurement (1928), MEINERTZHAGEN avait publié une utile liste nominale d'ensemble, accompagnée d'une carte, dans son article bien connu sur la zoogéographie des Himalayas. Il y reconnaissait 42 espèces, 3 de moins que BERLIOZ, mais tous deux réunirent les genres *Babax* David, 1875, et *Garrulax* Lesson, 1831.

Depuis la publication de ces deux ouvrages pionniers, des suppléments d'informations furent apportés : par moi-même (1959) dans *The Birds of the Palearctic Fauna* ; par RIPLEY (1961) pour celles des Indes ; et pour l'ensemble par DEIGNAN (1964) dans sa révision pour la « Check-list of birds of the world ». RIPLEY, DEIGNAN et moi-même reconnaissons *Babax*, et la distribution des deux genres est illustrée sur la carte (fig. 1). Dans son ensemble, cette carte est semblable à celle de MEINERTZHAGEN, quelques détails mis à part, avec l'exception plus notable qu'elle comprend Ceylan dans l'aire de distribution parce que dans le sud-ouest de cette île habite une espèce endémique (*G. cinereifrons* Blyth) que présume-

ment MEINERTZHAGEN et aussi BERLIOZ rapportaient auparavant à *Turdoides* Cretzschmar.

Considérations systématiques

Cet article est surtout une discussion de la distribution de *Babax* et *Garrulax*, et non pas une étude systématique, mais il doit prendre en considération la validité de *Babax* et les limites spécifiques de certains *Garrulax*. Notre compréhension taxonomique de ce groupe d'oiseaux est avancée mais quelques différences d'opinion persistent. Le cas de *cinereifrons* vient déjà d'être mentionné. Un autre concerne la position systématique de *phoenicea* Gould que BERLIOZ, MEINERTZHAGEN, et aussi RIPLEY placent dans le genre *Garrulax*, alors que DEIGNAN place cette espèce dans le genre *Liocichla* Swinhoe, où elle me semble aussi être mieux à sa place. Cette question avait déjà été étudiée par DELACOUR (1933), qui avait également placé *phoenicea* dans le genre *Liocichla*.

Babax est clairement apparenté à *Garrulax*, surtout aux espèces séparées antérieurement sous le genre *Ianthocincla*, mais il est généralement admis que ses trois espèces (*lanceolatus*, *waddelli*, et *koslowi*) forment un groupe à part ; elles se différencient de toutes les autres par leur livrée terne et très lourdement striée. Les deux seules espèces de *Garrulax* nettement striées (*striatus* Vigors et *lineatus* Vigors) ont une pattern des stries totalement différente. *Babax* diffère aussi de *Garrulax* par le bec moins turdiforme et beaucoup moins emplumé à la base et sur les narines, et aussi par la forme de la queue plus etagée. C'est dire que les relations systématiques sont à mon avis plus clairement exprimées par l'admission de *Babax*, quoiqu'il faille admettre que les différences morphologiques mentionnées ne sont peut être pas très importantes au niveau du genre (voir aussi DELACOUR (1946), qui a reconnu *Babax* comme formant la transition entre *Turdoides* et *Garrulax*).

Les autres espèces, maintenant toutes incluses dans *Garrulax*, étaient antérieurement réparties dans un grand nombre de genres ; DEIGNAN (*op. cit.*) donne une liste de 18 synonymes ! Parmi ceux-ci, *Ianthocincla* Gould, 1835, *Trochalopteron* Blyth, 1843, *Grammatoptila* Reichenbach, 1850, et *Dryonastes* Sharpe, 1883, ont été les plus usités et certains voudront peut-être les considérer comme sous-genres

Il y a aussi des différences d'opinion concernant le nombre des espèces, et il me semble certain que DEIGNAN a réuni trop de formes qui sont véritablement ou probablement des espèces distinctes. Dans le cas des formes paléarctiques que je connais le mieux, il ne me semble pas que *lunulatus* Verreaux, 1871, soit conspécifique de *bieti* Oustalet, 1897, comme le pense DEIGNAN, car l'état actuel de nos connaissances suggère que leurs distributions empiètent l'une sur l'autre dans le Setchouan occidental. Je préfère aussi ne pas suivre DEIGNAN quand il réunit *caerulatus* Hodgson, 1836, et *poecilorhynchus* Gould, 1863, parce que leurs livrées sont vraiment trop différentes : tous les *caerulatus*, quelle que soit leur sous-espèce, ont la gorge et la poitrine d'un blanc pur qui tranche absolument avec les joues et les côtés du cou bruns et les flancs gris et bruns, tandis que toutes les formes de *poecilorhynchus* ont la gorge et le haut de la poitrine bruns et concolores avec les joues et les côtés du cou, le bas de la poitrine étant gris et se fondant avec les flancs. Les aires de distribution de ces deux oiseaux se rapprochent dans le nord-ouest du Yunnan mais n'ont pas l'air d'empiéter l'une sur l'autre, du moins d'après ce que nous en savons ; mais dans le cas de *lunulatus* et *bieti*, qui apparemment se chevauchent, nous devons constater que la coloration du plumage et sa pattern sont similaires, à quelques petits détails près. Ceci devrait nous faire hésiter à réunir des formes dont la coloration et la pattern sont très différentes quand il n'y a aucun signe d'intercroisement.

Dans le cas de l'Inde tropicale, DEIGNAN considère que *nuchalis* Godwin-Austen, 1876, et *chinensis* Scopoli, 1786, sont conspécifiques comme le sont *jerdoni* Blyth, 1851, et *cachinnans* Jerdon, 1839, quoique RIPLEY, dont j'accepte l'opinion, traite les quatre oiseaux comme espèces séparées dans son inventaire des oiseaux de l'Inde.

BERLIOZ (1930) avait déjà conclu que les oiseaux des trois paires mentionnées ci-dessus (*caerulatus-poecilorhynchus*, *lunulatus-bieti*, *nuchalis-chinensis*), n'étaient pas conspécifiques quoique apparentés, mais considérait que *jerdoni* l'était avec *cachinnans*. Ces deux derniers ne nichent peut-être pas exactement dans le même district mais habitent des régions très voisines à l'ouest de Madras, ce qui a peut être influencé RIPLEY. *Cachinnans* a la poitrine rousse et la gorge noire, non striées, mais ces parties sont gris pâle chez *jerdoni*

et légèrement striées. Ce déplacement de caractère chez deux formes voisines suggère, je crois, qu'elles ne sont pas conspécifiques.

En résumé, j'augmente de quatre la liste des 44 espèces de *Garrulax* admises par Deignan, soit un total de 48. Il est possible que ce chiffre soit encore augmenté quand nous connaîtrons mieux la distribution de certaines formes des montagnes de l'ouest de la Chine. *Garrulax* est donc, de beaucoup, le genre des Timaliinés le plus riche en espèces.

Distribution régionale

Le Professeur Berlioz (1930) a insisté sur le fait que *Garrulax* est essentiellement caractéristique de la faune orientale, et Meinertzhagen (1928) pense que ce genre a colonisé les Himalayas depuis la Chine occidentale, probablement à partir d'un centre de dispersion situé au Setchouan et au Yunnan.

Je partage la même opinion, mais il me semble que le centre de dispersion doive être placé un peu plus au sud, dans le Yunnan et la partie indo-chinoise de la région orientale, mais je tiens à signaler que *Garrulax* et *Babax*, loin d'être restreints à la région orientale, sont aussi très bien représentés dans la région paléarctique. La distribution que nous constatons de nos jours dans cette dernière région dérive peut-être des relictes occasionnées par l'élévation des Himalayas, ou par une expansion plus récente vers le nord. Sans doute les deux facteurs ont-ils joué et semblent avoir été suivis par un degré bien marqué de spéciation.

Dans la région paléarctique, nous trouvons maintenant les 3 espèces de *Babax*, deux y sont endémiques, ainsi que vingt et une des 48 espèces de *Garrulax*, dont six sont endémiques. L'une d'elles (*lineatus*) habite le Turkestan russe, c'est-à-dire bien au nord des puissantes et hautes barrières de l'Indou-Kouch et du Tien Chan ; elle représente soit une relicte, soit une expansion du nord ouest des Himalayas. Les vingt autres habitent le nord et l'ouest de la Chine au nord du Yangtsé, c'est à dire au nord de la ligne qui sur la carte (fig. 1) indique la limite sud de la région paléarctique. Beaucoup de ces espèces vivent à de très hautes altitudes, et l'une d'elles *davidi*, s'étend vers le nord jusqu'à 49° de latitude environ

dans la Mongolie Intérieure et la Mandchourie de l'ouest ; onze de ces 20 espèces habitent le Kansou et la Tsinghai, et 13 le Tibet ; il est certain qu'aucun de ces pays ne fait partie de la région orientale. J'ai ajouté *Babax waddelli* aux espèces endémiques de la région paléarctique avec raison quoiqu'il

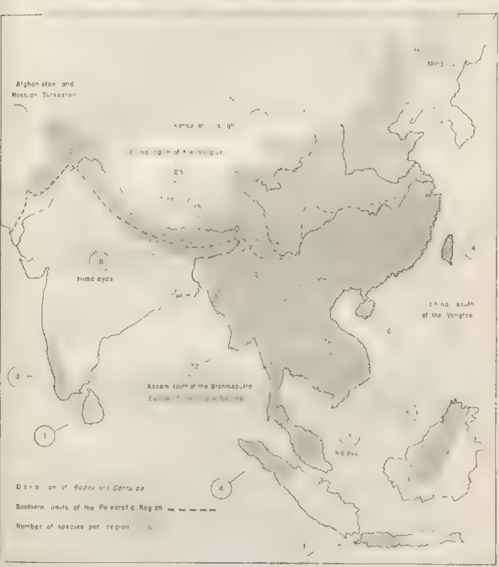


Fig. 1. — Distribution des genres *Garrulax* et *Babax*

habite aussi l'est des Himalayas, mais seulement aux très hautes altitudes dans l'extrême nord est du Sikkim, ce qui ne constitue qu'une petite extension du plateau tibetain voisin.

La liste des espèces qui suit est etablie par régions ; elle montre que dix-huit d'entre elles habitent les Himalayas mais qu'une seule (*variegatus*) est endémique Toutes les autres habitent aussi la Chine occidentale ou la sous-région Indo-Chinoise, ce qui vient à l'appui de l'opinion avancée par Meinertzhagen pour qui *Garrulax* a colonisé les Himalayas en venant de l'est.

La sous-région Indo-Chinoise est la plus riche (32 espèces), ce qui vient à l'appui de ma théorie quand je considère cette région comme le centre le plus actif de spéciation et d'expansion. Six espèces habitent l'île d'Hainan, et quatre Formose, mais l'une de ces dernières (*poecilorhynchus*) ne se trouve pas dans la sous région Indo-Chinoise et provient sans doute de la Chine.

A l'exception de l'Afghanistan et du Turkestan, avec leur espèce solitaire (*lineatus*), toutes les autres régions occupées par *Garrulax* se trouvent sur la lisière extrême de sa distribution et n'ont que peu d'espèces ; la plupart sont endémiques et paraissent être des relictes.

Nous trouvons aussi 6 espèces endémiques dans la sous région Indo-Chinoise, mais à l'exception de *strepitans* qui a une distribution assez considérable allant du Laos occidental à la Birmanie de l'est et du sud, les autres (*milleti*, *vassali*, *yersini*, *virgatus* et *austeni*) habitent une aire très limitée. Elles sont restreintes a un ou deux petits systèmes montagneux en Indochine, Birmanie, ou dans l'Assam, et je crois que nous pouvons les considérer aussi comme des relictes.

Espèces par région

Mongolie Intérieure et Mandchourie (1) : *Garrulax davidi.*

Kansou et Tsingha. (11) : *Babax lanceolatus*, *B. koslowi*, *Garrulax davidi*, **G. sukatschewi** [2], *G. cineraceus*, *G. lunulatus*, *G. maximus*, *G. ocellatus*, *G. canorus*, *G. sannio*, *G. elliotii.*

Tibet (13) : *Babax lanceolatus*, **B. waddelli** [2], *B. koslowi*, *Garrulax*

(1) Le nom des espèces endémiques est imprimé en caracteres gras
(2) Considéré comme endémique, voir texte.

albogularis, *G. striatus*, *G. maximus*, *G. ocellatus*, *G. sannio*, *G. lineatus*, *G. elliotii*, *G. henrici*, *G. affinis*, *G. erythrocephalus*.

Chine au nord du Yangtsé, y compris les régions précédentes (23) *Babax lanceolatus* **B. waddelli**, **B koslowi**, *Garrulax perspicillatus*, *G. albogularis*, *G. striatus* *G. maesi* [3], **G. davidi**, **G. sukatschewi**, *G. cineraceus*, **G. lunulatus**, *G. bieti*, **G maximus**, *G. ocellatus* *G. poecilorhynchus*, *G. canorus*, *G. sannio*, *G. lineatus*, *G. elliotii*, *G. henrici*, *G. affinis*, *G. erythrocephalus*, *G. formosus*.

Chine au sud de Yangtsé (21) : *Babax lanceolatus*, *Garrulax perspicillatus*, *G. albogularis*, *G. leucolophus*, *G. monileger*, *G. pectoralis*, *G. maesi*, *G. chinensis*, *G. galbanus*, *G. cineraceus*, *G. caerulatus*, *G. poecilorhynchus*, *G. merulinus*, *G. canorus*, *G. sannio*, *G. squamatus*, *G. subunicolor*, *G. elliotii*, *G. erythrocephalus*, *G. formosus*, *G. milnei*

Assam au sud du Brahmaputra, Birmanie, Siam et Indochine (32) *Babax lanceolatus*, *G. perspicillatus*, *G. albogularis*, *G. leucolophus*, *G. monileger*, *G. pectoralis*, *G. striatus*, **G. strepitans**, **G. milleti**, *G. maesi*, *G. nuchalis*, *G. chinensis*, **G. vassali**, *G. galbanus*, *G. delesserti*, *G. cineraceus*, *G. rufogularis*, *G. ocellatus*, *G. caerulatus*, *G. ruficollis*, *G. merulinus*, *G. canorus*, *G. sannio*, **G. virgatus**, **G. austeni**, *G. squamatus*, *G. subunicolor*, *G. affinis*, *G. erythrocephalus* **G. yersini**, *G. formosus*, *G. milnei*.

Himalayas (18) : *Babax waddelli*, *Garrulax albogularis*, *G. leucolophus*, *G. monileger*, *G. pectoralis*, *G. striatus*, *G. nuchalis*, *G. delesserti*, **G variegatus**, *G. rufogularis*, *G. ocellatus*, *G. caerulatus*, *G. ruficollis*, *G. lineatus*, *G. squamatus*, *G. subunicolor*, *G. affinis*, *G. erythrocephalus*.

Afghanistan et Turkestan russe (1) : *Garrulax lineatus*.

Sud-ouest et sud de l'Inde (3) : *Garrulax delesserti*, **G. cachinnans**, **G. jerdoni**.

Ceylan (1) : **Garrulax cinereifrons**

Formose (4) : *Garrulax albogularis*, *G. poecilorhynchus*, *G. canorus*, *G. affinis*.

Hainan (6) : *Garrulax monileger*, *G. pectoralis*, *G. maesi*, *G. chinensis*, *G. canorus*, *G. sannio*.

Malaisie et Grandes Sondes (6) : **Garrulax palliatus** (Sumatra et Bornéo), **G. rufifrons** (Java), *G. leucolophus* (Sumatra), **G. lugubris** (Malaisie et Bornéo), **G. mitratus** (Malaisie, Sumatra et Bornéo), *G. erythrocephalus* (Malaisie).

Distribution altitudinale

Les oiseaux du genre *Garrulax* habitent surtout les collines ou les régions franchement montagneuses, le plus souvent à des élévations moyennes, quoiqu'un groupe d'espèces

(3) Delacour (1946, p. 27) considère que *maesi* fait part d'une super-espèce avec *strepitans*, *milleti* et *ferrarius*. C'est dire que *ferrarius* Riley, 1930 (qui est considéré comme une sous-espèce de *strepitans* Blyth, 1855, par Deignan, 1964, p. 357) peut constituer, à mon point de vue, une espèce particulière qui porterait, dans ce cas, le nombre des espèces de *Garrulax* à 49.

niche à basse altitude, descendant au pied des montagnes et dans les plaines ; seul un autre groupe habite à très haute altitude, montant à la limite des arbres et même au-dessus, dans la zone des buissons arborescents. La variation altitudinale de certaines espèces ne semble pas dépasser beaucoup plus de 1.000 mètres, apparemment même beaucoup moins pour certaines, mais pour d'autres (telles que *Garrulax cine-*

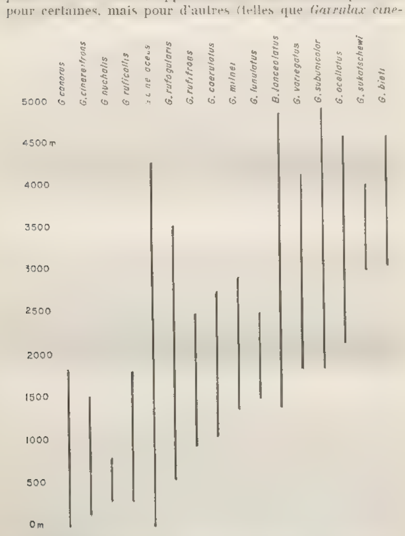


Fig. 2. — Variation altitudinale dans certaines espèces des genres *Babax* et *Garrulax*

racemus et *G. sannio* elle est énorme, ces deux oiseaux nichant à partir du niveau de la mer sur la côte de la Chine jusqu'à 4.700 mètres dans le nord-ouest du Yunnan

Les trois *Babax* nichent plus haut que la grande majorité des *Garrulax*, jusqu'à 4.000 et même 4.850 m : apparemment, pas au-dessous de 3.050 dans le cas de *B. waddelli* et 3.900 dans celui de *B. koslowi*, mais *B. lanceolatus* qui est beaucoup plus largement distribué que les deux autres, niche aussi en régions tropicales et descend jusqu'à 1.400 mètres.

Toutes les espèces des deux genres sont notées comme très sédentaires, ce qui n'exclut pas quelques déplacements locaux limités, et elles peuvent être forcées de descendre beaucoup plus bas pendant l'hiver lorsque les conditions sont inclémentes. Par exemple, dans les Himalayas, la race nominale de *G. variegatus* niche entre 7.000 et 13.500 pieds d'après Ripley (1961, p. 386), qui nous dit qu'elle a été signalée à 3.500 pieds pendant l'hiver. Dans la liste qui suit, je n'ai donc pas tenu compte de ces records hivernaux en basse altitude pour les espèces qui ne sont reconnues nicheuses qu'à hautes élévations. Je mentionne seulement le plus bas et le plus haut record ; sans doute en existe-t-il d'autres un peu plus bas ou un peu plus haut, qui seront fournis par des collections futures.

Cette liste fut établie d'après des sources diverses et c'est, je crois, la première liste qui donne des records pour toutes les espèces. Les records d'altitude sont assez abondants pour certaines régions montagneuses où l'on a beaucoup collecté, comme dans plusieurs secteurs des Himalayas, mais, comme on peut s'en douter, ils sont moins abondants pour le Tibet et la Chine occidentale, alors qu'ils sont très pauvres pour d'autres régions, à moins même qu'ils ne fassent complètement défaut.

La littérature sur *Garrulax* est si volumineuse qu'il m'a fallu me restreindre aux études les plus compréhensives ou les mieux connues. Parmi celles-ci, je mentionne, en plus de mon ouvrage (1959), et de celui de Ripley (1961), l'étude de Meinertzhagen (1927) sur les Himalayas, la série de Ludlow sur les Himalayas de l'est et le sud du Tibet (1927-1928, 1937, 1944, 1950, et 1951), celle de Berlioz (1930), les deux par Riley (1926 et 1931) sur la Chine occidentale, Greenway (1933) sur l'extrême nord-ouest du Yunnan. Bangs et Peters

(1928) sur le Kansou occidental et la Tsinghai orientale, l'inventaire des oiseaux de la Chine par CHENG (1958), HACHISUKA et UDAGAWA (1951) sur Formose, DEIGNAN (1945) pour le nord du Siam, et les ouvrages généraux sur la Malaisie par ROBINSON (1928), la Birmanie par SMYTHIES (1953), Bornéo par le même auteur (1960), et sur l'Indochine par DELACOUR et JABOUILLE (1931).

J'ai aussi consulté les étiquettes des spécimens dans la collection de l'American Museum of Natural History, et dans certains cas, particulièrement pour les espèces très rares ou très peu connues et pour lesquelles l'information fait défaut, j'ai recherché sur cartes l'altitude des localités où l'oiseau a été trouvé.

Les espèces sont classées ci-après en plusieurs catégories qui correspondent à la variation sur le continent quand la même espèce habite aussi une île, comme Formose ou Haïnan, mais ne donne pas de records pour Haïnan. Je n'en ai pas trouvé pour cette île dans le rapport de base par HARTERT (1910) ou sur les étiquettes de la grande série que j'ai examinée et qui fut, d'ailleurs, étudiée en grande partie par HARTERT. A l'exception d'une localité dans la basse plaine et une autre sur la côte où *G. chinensis* a été collecté, les seules localités que j'ai pu trouver sur la carte sont la chaîne des « Five Fingers » et le « Mount Wuchi ». *Chinensis* a été pris aussi dans la chaîne qui a peut-être une altitude moyenne de 1.000 mètres à l'exception du Mont Wuchi qui atteint 1 879 et sur lequel quatre des autres espèces d'Haïnan ont été collectées (*G. pectoralis*, *G. maesi*, *G. monileger* et *G. canorus*), mais pas *chinensis*. Je n'ai pas d'information sur la sixième espèce (*G. sannio*) que DEIGNAN (1964) ne mentionne pas pour Haïnan mais qui a été signalée en dehors d'Haïnan par CHENG (1958) et par moi (1959, p. 432) ; malheureusement je n'ai pas gardé de note sur la localité et je n'ai pas pu la retrouver.

La variation altitudinale de deux espèces, ou plus, de chaque catégorie est illustrée graphiquement dans la figure 2.

Espèces de basses altitudes ne dépassant pas 2.100 mètres environ (15) : *Garrulax cinereifrons* (150-1.525), *G. leucolophus* (300-2.135), *G. monileger* (300-1.500), *G. pectoralis* (300-1.700), *G. lugubris* (600-1.900), *G. strepitans* (900-1.675), *G. milleti* (900-1.525), *G. chinensis* (niveau de la mer ou 200-1.375), *G. nuchalis* (300-800), *G. vassali* (100-2.135), *G. galbanus* (300 ou 500-1.830), *G. delesserti* (60-1.830), *G. mitra*

tus (300-1.575), *G. ruficollis* (300-2.000), *G. canorus* (niveau de la mer-1.830, et des plaines basses à 1.200 à Formose).

Espèces s'étalant des basses aux hautes altitudes (4) : *G. perspicillatus* (niveau de la mer-3.000), *G. cineraceus* (niveau de la mer ou 200-4.270). *G. rufogularis* (610-3.535), *G. sannio* (300-4.270).

Espèces d'altitudes moyennes ne dépassant pas 3.000 mètres (14) : *G. palliatus* (1.220-2.230), *G. rufifrons* (915-2.500), *G. striatus* (800-2.740), *G. lunulatus* (1.500-2.500), *G. caerulatus* (1.065-2.750), *G. merulinus* (900-2.440), *G. cachinnans* (1.220-2.650), *G. jerdoni* (1.070-2.135), *G. virgatus* (915-2.470), *G. austeni* (1.840-3.000), *G. squamatus* (1.070-3.000), *G. yersini* (1.800-2.500), *G. formosus* (900-3.000), *G. milnei* (1.375-2.800).

Espèces d'altitudes moyennes dépassant 3.000 mètres (13) : *Babax lanceolatus* (1.400-1.830), *Garrulax albogularis* (1.220-4.575, et de 900 à 1.500 à Formose), *G. maesi* (800-3.650), *G. variegatus* (1.830-4.120), *G. davidi* (2.550-4.000, mais nichant à environ 1.000 en Mongolie et Mandchourie), *G. maximus* (2.165-4.575), *G. ocellatus* (2.165-4.575), *G. poecilorhynchus* (1.500-4.575, et 1.200-2.100 à Formose), *G. lineatus* (1.435-3.660, mais environ seulement 1.000-2.500 au Turkestan russe), *G. subunicolor* (1.830-4.880), *G. elliotii* (2.450-4.880), *G. affinis* (2.440-4.880, et 2.000-3.000 à Formose), *G. erythrocephalus* (1.340-3.660).

Espèces restreintes aux très hautes altitudes (5) : *Babax waddelli* (3.050-4.000), *B. koslowi* (3.900-4.300), *Garrulax sukatschewi* (3.000-4.000), *G. bieti* (3.050-4.575), *G. henrici* (2.930-4.575).

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SPECIMENS OF LEAR'S MACAW IN THE ZOOLOGICAL MUSEUM OF AMSTERDAM

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The following remark by Stager 1961, referring to the Machris Brazilian Expedition of 1956, reminded me of the presence of two unpublished specimens of Lear's Macaw in the Zoological Museum of the University of Amsterdam « A careful watch was kept for individuals of the rare *Anodorhynchus leari*, whose habitat is yet to be discovered, but no trace of the species was found in central Goiás » (p. 15)

In the old collection of mounted birds, which formerly belonged to the cabinet of the Amsterdam Zoological Gardens, I found five specimens of blue macaws, two belonging to the species *hyacinthinus*, one to *glaucus*, and two to *leari*. The data follow below :

Anodorhynchus hyacinthinus (Latham)

Coll Nr. 939. ♀. « Brazil ». Wing 417, bill 87.5 mm.
940. ♂ Zool. Garden Amsterdam, 7 April, 1884. Wing 438, bill 91.7 mm.

Anodorhynchus glaucus (Vieillot)

Coll. Nr. 941 ♂. « Rio de la plata ». Wing 365, bill 68.2 mm.

Anodorhynchus leari Bonaparte

Coll. Nr 942. « South America ». Wing 405, bill 67.1 mm
943. Zool. Garden Amsterdam, 1882. Wing 391, bill 71.0 mm.

Up to now no more than two specimens of *A. leari* were known to exist in collections : one being the type specimen in the Paris Museum (Bonaparte, *Naumannia*, 6, 1856, Consp. Psitt., Beil. 1 ; Souancé, Iconographie des Perroquets, Paris,

1857, pl. 1) ; the other being a Zoological Garden (London) bird in the British Museum, Natural History (SALVADORI, Cat. Birds Brit. Mus., 20, 1891 149). The origin nor the exact dates, of these birds are known.

Anodorhynchus leari is in coloration and size a wonderful intermediate between the well known, large, Blue Macaw from central Brazil, and the equally well-known, smaller, Glaucous Macaw from southeastern Brazil, Paraguay, Uruguay, and extreme northern Argentina. In the Amsterdam specimens of *leari*, which perfectly agree with Blanchard's picture in SOUANCE (*op. cit.*), the upper parts are deep blue, but less intense than in *hyacinthinus* ; head, neck, and under parts have a decided greenish wash, the greenish tinge of the head contrasting remarkably with the blue of the mantle. *Hyacinthinus* is deep cobalt blue all over, and *glaucus* is greenish blue with a distinct greyish tinge on the head and the neck, and a still darker grey wash over the feathers of the throat and upper breast.

Apart from the specimens mentioned above captive Lear's Macaws have been recorded to have been seen by BONAPARTE in the Antwerpen Zoo in the 1850's (SOUANCÉ, *op. cit.* and to have been imported about 1925 from Pará to New York *fide* Lee CRANDALL, and in the 1930's to Germany (*fide* Oscar NEUMANN ; PETERS, 1937 : 180, foot-note 1).

In practically all of the scientific and popular works on parrots (including CORY, 1918 ; PETERS, 1937 ; LEGENDRE, 1962) Lear's Macaw is listed as a third species of the group of blue macaws. In view of the fact that the areas of *A hyacinthinus* and *A. glaucus* are almost complementary, though probably more or less separated by the Brazilian Plateau, one would be anxious to know whether there are places where these species actually meet or overlap, and whether perhaps *A. leari* is no more than the result of a regular or sporadic, former or present, reproductive contact of *hyacinthinus* and *glaucus*, and hence, in some way or another, a hybrid.

The present scanty knowledge about this large and conspicuous bird makes it unlikely, though not impossible, that it represents an independent species, of unknown geographic origin, intermediate between *hyacinthinus* and *glaucus*.

The present author would feel highly rewarded, if this

small note could stimulate someone to design accurate distribution maps of the two well-known species of *Anodorhynchus* (which may prove a hard task ! and to show that these species have arisen through an almost classical way of geographic isolation in parts of Brazil, roughly north and south of the Brazilian Plateau.

RESUME

Partant des specimens en peaux existant en collections, et des informations recueillies dans la littérature, l'auteur nous donne son point de vue sur la position systématique de l'Ara de Lear, qui est probablement une forme hybride de l'Ara bleu et l'Ara glauque, tout en souhaitant qu'une carte de distribution précise des deux espèces bien connues d'*Anodorhynchus* puisse être bientôt établie.

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ADDITIONS TO THE LIST OF BIRDS OF THE REPUBLIC OF COLOMBIA

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The observations that follow have come to attention during studies directed toward an account of the avifauna of the Isthmus of Panamá. In connection with these it has been necessary to review many species of birds that are found also in northern Colombia at the southern end of the great land bridge that connects the American continents. For this purpose collections have been assembled from little known areas in the Department of Chocó.

It is appropriate to include these notes among those that honor M. Jacques BERLIOZ in recognition of his many contributions concerned with the birds of tropical America.

A) DESCRIPTIONS OF NEW GEOGRAPHIC RACES

Picumnus olivaceus malleolus subsp. nov.

CHARACTERS. — Similar to *Picumnus olivaceus panamensis* Ridgway of eastern Panamá (1), but darker above, more olive green ; breast and foreneck definitely browner ; streaks on under surface darker and heavier ; male with crown spots more yellow, less reddish orange ; slightly larger.

DESCRIPTION. — Holotype, U. S. National Museum no. 401870, male, La Raya, Bolivar, Colombia, collected Jan. 11, 1948, by M. A. CARRIKER, Jr. (orig. no. 12019). Crown and hindneck black ; pileum with small, elongated spots of

(1) *Picumnus olivaceus panamensis* Ridgway, *Proc. Biol. Soc. Washington*, vol. 24, Feb. 24, 1911, p. 34 (Lion Hill Station, Panama Railroad, Canal Zone, Panamá).

yellow ocher ; hindneck with scattered dots of white ; back, scapulars, and rump, light brownish olive ; wing coverts the same, margined very narrowly with chamois ; primaries and secondaries dusky with the outer web of the outer primaries edged narrowly with buffy olive ; innermost primaries and secondaries bordered more widely with dull old gold ; upper tail coverts colonial buff, rectrices black, the central pair with the inner web broadly yellowish white, the others tipped and margined with yellowish white, side of head scantily feathered with dull white, the tiny feathers edged with black ; throat dull white, foreneck and upper breast isabella color, somewhat paler centrally ; rest of under surface, including the under tail coverts, somewhat dull buffy white, streaked, rather narrowly, with dull olive ; under wing coverts light buff, mixed externally with brownish olive ; inner webs of primaries margined narrowly with buffy white. Bill dark neutral gray basally, black distally ; tarsus, toes, and claws fuscous black (in dried specimen).

Measurements. Males (16 specimens), wing 50.6 - 55.7 (52.6), tail 23.4 - 26.6 (25.5 average of 15), culmen from base 11.1 - 12.6 (11.8, average of 15), tarsus 11.2 - 13.3 (12.3) mm.

Females (12 specimens), wing 51.3 - 53.3 (52.2), tail 24.0 - 26.7 (25.4), culmen from base 11.0 - 13.0 (11.8, average of 11), tarsus 11.4 - 13.5 (12.4) mm.

Range. Tropical lowlands of northern Colombia, in Córdoba (Socarre and Quebrada Salvajín on the Río Sinú), northern Antioquia (El Pescado, near Valdivia), and Bolívar (Regeneración, La Raya, Volador, Santa Rosa, Colosó) in the drainage of the lower Río Cauca and the lower Río Magdalena ; intergrades with *Picumnus o. tachirensis* east of the Río Magdalena at Ocaña, Norte de Santander, and with *P. o. olivaceus* on the upper Río Nechí, near Hacienda Belén above Zaragosa, northeastern Antioquia.

Remarks. The few specimens of this piculet previously available from northwestern Colombia, with an equally small number from Panamá east of the Canal Zone have been identified to the present as the typical race *Picumnus olivaceus olivaceus*. With the excellent series now at hand it is easily evident that *Picumnus olivaceus panamensis* Ridgway, named in 1911 from the Canal Zone, is a valid race, with a range extending through eastern Panamá, where it is recor

ded on both Pacific and Caribbean slopes, to northern Chocó, Colombia (specimens from near Unguía). The population spread through northwestern Colombia, east of the Atrato drainage, represents another form that differs from *panamensis* as indicated in the description above. The typical race, *P. o. olivaceus*, is darker, more olive above, less definitely brown on the breast, with crown spots of the male decidedly deep orange. At one of CARRIKER's localities, the Hacienda Belén, on a tributary of the Río Nechí about 15 kilometers northwest of Segovia, he collected two males ; one, taken in the valley below the farm, with the head spots colored as in *malleolus*, but otherwise like *olivaceus*, and the other, from the hills above, that is typical *olivaceus*. The indication is that *malleolus* ranges up the Río Nechí from its union with the Río Cauca to near this point.

These tiny woodpeckers in feeding peck so constantly and industriously, with as much noise as any of their larger relatives, that it seems appropriate to name this one *malleolus*, a small hammer.

Heterospingus xanthopygius berliozi subsp. nov.

CHARACTERS. — Similar to *Heterospingus xanthopygius xanthopygius* (Sclater) (1) but definitely darker : Male decidedly deeper black, with the yellow of lower back, rump, and lesser wing coverts darker ; female darker above, decidedly darker below, with the yellow of lower back and rump darker.

DESCRIPTION. — Holotype U. S. National Museum no. 443762, male, from Nuquí, Chocó, Colombia, collected March 5, 1951, by M. A. CARRIKER, Jr. (original number 19777). Side of head and upper surface, except as noted, black ; superciliary stripe narrowly white immediately above eye, then, more broadly scarlet-red back to nape ; lesser wing coverts, lower back and rump between lemon chrome and lemon yellow ; foreneck and upper breast black, somewhat duller than the upper surface ; rest of lower surface fuscous black ; inner under wing coverts, axillars, and side of breast

(1) *Tachyphonus xanthopygius* P. L. Sclater, *Proc. Zool. Soc. London*, pt. 22, 1854 (April, 1855), p. 158, pl. 69 (Bogotá, Colombia).

(beneath the anterior end of the wing) white. Bill, tarsus, and feet black (from dried skin).

MEASUREMENTS. Males (6 specimens), wing 90.5 - 94.0 (92.1) ; tail 60.2 - 64.5 (62.9) ; culmen from base 18.4 - 19.6 (18.8) ; tarsus 21.7 - 22.5 (22.2) mm.

Females (3 specimens), wing 86.2 - 92.2 (88.0) ; tail 63.8 - 65.4 (64.1) ; culmen from base 19.2 - 20.5 (19.9) ; tarsus 20.5 - 21.8 (20.9) mm.

RANGE. Pacific slope of western Colombia from northern Chocó (Bahía Solano, Nuquí, Jurubidá) south to Caldas (Santa Cecilia) and Nariño (Guayacana).

REMARKS. The definitely darker color of the series from which this form is described may be explained as a reflection of the greater rainfall of the coastal area of the northern Chocó. The series examined stands out clearly in comparison with 14 males and 7 females that cover the range of *Heterospingus xanthopygius xanthopygius* from eastern Darién in Panamá across northern Colombia to northern Santander. Those from the Río Juradó, in northern Chocó, are intermediate between the form here described and the nominate race, which is found on the Río Jaqué, Darién, a short distance to the north. Skins in the Academy of Natural Sciences, available through the kindness of R. M. de SCHAUENSEE, show that the subspecies *berliozi* ranges south over the Pacific slope to Nariño in southwestern Colombia. It is probable that this is also the bird of northwestern Ecuador.

The name of this race is given to honor Jacques BERLIOZ in recognition of his contribution to knowledge of the avifauna of tropical America. It is offered as a token of our friendship through many years of association in researches in the field of ornithology.

B) ADDITIONAL RECORDS FOR THE LIST OF BIRDS OF COLOMBIA

The following notes cover several forms not reported previously from the Republic of Colombia. The records are based on specimens that I have identified recently in collections in the U. S. National Museum. The names are presented in systematic order.

Catoptrophorus semipalmatus semipalmatus (Gmelin). — R. M. SCHAUENSEE in his recent book on The Birds of Colombia (1964, p. 83, in an account of the Willet lists the western subspecies, *Catoptrophorus semipalmatus inornatus*, with the remark that the typical form « probably occurs » This supposition is verified by a female specimen in the U. S. National Museum taken by M. A. CARRIKER, Jr., at Coveñas, Bolívar, on Jan. 10, 1949. Measurements of wing 192.0 mm., exposed culmen 58.2 mm., and tarsus 55.8 mm., place this specimen with the smaller eastern subspecies.

Actitis macularia rava Burleigh. — Thomas BURLEIGH in a recent review of the Spotted Sandpiper, *Actitis macularia*, has described a western race under the name *A. m. rava*, on the basis of lighter, grayer coloration above at all seasons, and a further minor distinction in a lesser amount of spotting on the lower surface in the plumage of the breeding season. Both the eastern and the western subspecies are represented in the small series of Spotted Sandpipers in the Colombian collections made by CARRIKER for the U. S. National Museum. A male in winter dress, typical of the eastern race, *A. m. macularia*, was taken at Nuqui, Chocó, on Jan. 22, 1951. Specimens of *A. m. rava*, all in winter plumage, come from Unguia, Chocó, Feb. 28, 1950, Necoclí, Antioquia, Jan. 26, 1950, and Coveñas, Bolívar, Jan. 13, 1949.

Columba nigrirostris Sclater. — The Short-billed Pigeon ranges through the length of the Isthmus of Panamá so that it is not unexpected to find it in northwestern Colombia. CARRIKER collected a male in heavy forest west of Acandi, Chocó, Jan. 10, 1950. There is also a specimen in the American Museum of Natural History taken by H. E. ANTHONY and D. S. BALL March 29, 1915, on the eastern slope of Cerro Tacarcuna near the headwaters of the Rio Cutí, Chocó. In February and early March, 1964, I found these pigeons common on Cerro Malí and the middle slopes of Cerro Tacarcuna in Darién adjacent to the Colombian boundary. It was evident that they ranged throughout the forest that extended without a break across into adjacent Chocó.

Otus clarkii Kelso and Kelso. — During work in the mountains of eastern Darién, on March 3, 1964, Charles

O. Handley, Jr. and I secured a male Bareshanked Screech Owl in a mist net set on a ridge of Cerro Tacarcuna, exactly on the line of the international boundary of the two republics of Panama and Colombia. The slopes on both sides of the line are forested, with no distinction in habitat. The specimen is interpreted as a valid record for both countries, and on that basis is the first report of the species for Colombia. Several were recorded on the Darien side of the boundary.

Glaucidium minutissimum minutissimum (Wied). — A male Least Pygmy Owl collected by M. A. Carriker, Jr., April 12, 1949, in virgin forest near the Rio Sinú, at Socarre, Córdoba, is the first record for Colombia. The place, called locally La Dispensa, is about two and one half kilometers below the mouth of the Rio Verde. The specimen agrees in color with those seen of the typical race from Brazil.

Speotyto cunicularia brachyptera Richmond. — In 1941 in the Guajira, in northeastern Colombia M. A. Carriker, Jr. and I collected three Burrowing Owls of this race near Maicao on April 11, and one at Puerto López, on April 22. These agree in pale coloration with specimens from northern Venezuela where this subspecies is widely distributed.

Goldmania violiceps Nelson. — Goldman's Hummingbird is common in the Serranía del Darien on the Panamanian side of the boundary on Cerro Malí, and over the slopes of Cerro Tacarcuna. On March 2, 1964 we caught one in a mist net set at 1460 meters elevation at the crest of the ridge on the boundary with Colombia. The occurrence of this species here has been overlooked, as there are two females and an immature male in the American Museum of Natural History taken by H. E. Anthony on his expedition in 1915. The three birds, labelled « East slope of Mt. Tacarcuna, alt. 1600 feet, eastern Panamá », were collected April 10, 14, and 17, when the party was camped on the head of the Rio Cuti. Department of Chocó, Colombia.

Picumnus olivaceus panamensis Ridgway. — Two specimens of the Olivaceous Piculet taken by Carriker March 1 and 18, 1950, at Unguia, Chocó that agree fully with a series from eastern Panamá are the first report of this subspecies

from Colombia. PETERS in his Check-list (vol. 6, 1948, p. 90) placed *panamensis* as a synonym of *olivaceus*. In this he was misled by the scanty material that he had available, as birds from the Canal Zone through eastern Panamá are clearly different in more yellowish brown shade above, and buffy general coloration below, with the breast distinctly paler

RESUME

L'étude du matériel figurant dans les collections de l'U. S. National Museum a conduit l'auteur à décrire 2 formes nouvelles et à ajouter 8 espèces et sous-espèces à la liste des Oiseaux de Colombie.

A REVIEW OF THE SOUTHERN SUBSPECIES OF THE FAWN-COLOURED LARK *MIRAFRA AFRICANOIDES* SMITH

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When reporting on the Percy FitzPatrick Institute of African Ornithology – Windhoek State Museum expeditions to the Etosha Pan, I (WINTERBOTTOM, 1964) commented on the unsatisfactory state of the systematics of the Fawn-coloured Lark *Mirafra africanoides* Smith. The present paper is the outcome of that dissatisfaction.

The Fawn-coloured Lark occurs in two discrete groups of populations, one in south western Africa from the northern Cape Province to eastern Angola and western Zambia and the other in north-eastern Africa from northern Tanganyika to central Ethiopia and northern Somaliland. I make no attempt to deal with this second group and my remarks are confined to the southern populations.

Within the range of these populations, 15 subspecies have been described, no fewer than seven of them from north central South West Africa between 16° and 23°S and 16° and 19°E. The latest summaries available are those of McLACHLAN & LIVERSIDGE (1957) and WHITE (1961), and MACDONALD (1957) has commented on the South West African races. McLACHLAN & LIVERSIDGE recognise nine subspecies (one further subspecies is extra-limital to their work), suppressing one (*M. a. omaruru* Roberts) recognised by MACDONALD. White recognises eight subspecies, with another three as too poorly defined to be worth maintaining. The subspecies recognised by both these authorities (and by MACDONALD if they occur within the area with which he was concerned) are :

M. a. *africanoides* Smith,
M. a. *harei* Roberts,
M. a. *sarwensis* (Roberts),
M. a. *austinrobertsi* White,
M. a. *vincenti* (Roberts),
M. a. *makarikari* (Roberts),
M. a. *rubidior* White.

McLachlan & Liversidge and Macdonald both recognise also *M. a. gobabisensis* (Roberts), which White considers only separable at the 30 % level from *M. a. africanoides* ; and White also recognises *M. a. trapnelli* White, which is extralimital for the others. He suppresses *M. a. mossambiquensis* Pinto, recognised by McLachlan & Liversidge, as a synonym of *M. a. vincenti*.

All three authorities are agreed that *M. a. isseli* Hoesch & Niethammer is not a valid form and White also suppresses *M. a. quaesita* Clancey, which was described subsequent to the publications of the others (but see below). None recognise *M. a. ovambensis* (Roberts) or *M. a. tsumebensis* (Roberts) but whereas Macdonald fuses both with *M. a. sarwensis*, White puts the first with *sarwensis* as a poorly defined variation and the second with *M. a. africanoides* as an intergrade between that and *sarwensis*.

Finally, there is a nomenclatorial problem involving the use of the names *africanoides*, *austinrobertsi* and *quaesita*. White (1956) quotes personal information from Macdonald that Smith's types of *M. a. africanoides* do not agree with birds from Litakun, near Kuruman, which place Roberts had proposed as the type locality, but do agree with specimens from Colesberg, which White (1961) considers are *austinrobertsi*. Clancey (1958) points out that this finding means that *austinrobertsi* must be sunk in the synonymy of *africanoides* and has named the Kuruman birds *quaesita* ; but this depends on the identity of birds from Colesberg and from Nylstrom (the type locality of *austinrobertsi*), on which see below.

Enough has now been said, I hope, to reveal the differences of view. I have had at my disposal 478 skins and I must thank the following for the loan of material : The Director of the Durban Museum & Art Gallery (Mr. P. A. Clancey) ; the Director of the East London Museum (Miss M. Courtenay-Latimer and Mr. C. D. Quickelberge) ; the Director



Fig. 1. — Map of Southern Africa, showing ranges of subspecies of *Mirafra africanoides*. Hatched : Areas of intergradation and/or overlap.

and Mr. M. P. STUART IRWIN of the National Museum, Bulawayo ; the Director and Mr. P. J. BUYS of the State Museum, Windhoek ; the Director and Mr. O. P. M. PROZESKY of the Transvaal Museum, Pretoria ; Mr. J. HALL of the University Museum, Oxford ; and Mr. H. von MALTZAHN.

Variation in the Fawn-coloured Lark is considerable in colour, from deep red-brown in *rubidior* to grey and buff in *makarikari* ; and in the degree of dark striping above, and small in the extent of spotting below and in size. Colour changes and changes in the extent of striping are rarely abrupt ; and there is considerable overlap in the ranges of some of the subspecies, though whether this is due to local migration, to nomadism, to ecological factors or to some other cause we have not enough data to determine ; but the presence of many non breeding specimens of *M. a. sarwensis* from the Tsotsoroga Pan, 140 miles north of Maun, is pretty clear proof that considerable movements occur. As CLANCEY has pointed out (see above), the finding that SMITH's types agree with Colesberg, rather than Kuruman birds leaves the Kuruman and other northern Cape birds without a name, and he accordingly named them *quaesita*, type locality Rietfontein, Asbestos Mountains. Many of the birds from this area are richer, redder and less heavily streaked than *africanoides* but less so than *gobabisensis* (Roberts), which occupies the area to the north-west. However, if their range is plotted on a map, it is found to fall almost entirely within the ranges of the other two races and *quaesita* is best discarded as an intergrade between *africanoides* and *gobabisensis*, though a small area round the type locality appears to be populated solely by such birds. The total number of subspecies recognised below is 10, two more than WHITE (1961) recognises for the same area ; but four of these are not very well defined and could be suppressed without much distortion of the picture. The races are as follows :

1. MIRAFRA AFRICANOIDES AFRICANOIDES Smith

Mirafra africanoides A. Smith, Rept. Exp. Expl. C. Afr., 1836, 47 - Eastern province of the colony and Latakoo (restricted type locality, Colesberg, C. P.).

A dark race, heavily streaked above on a dark reddish brown ground.

Range. — The north-eastern Cape, from Colesberg and Prieska to Vryburg, and the adjacent parts of the Transvaal and Orange Free State. Intergrades with *gobabisensis* over a wide area of the northern Cape.

Measurements. — 34 ♂♂ : Wing 88-97 mm, av. 92.5 ; tail 53-63, av. 58.7 ; culmen, 15-17, av. 16.2 ; tarsus 18-24, av. 21.4.

4 ♀♀ : Wing 85-89 mm ; av. 87.2 ; tail 51-57, av. 53.7 ; culmen 15-16, av. 15.7 ; tarsus 19-22, av. 20.7.

Material examined. — Durban Museum, 9 (Kuruman, Riverton, Prieska) ; East London Museum, 20 (Griquatown, Kimberley, Barkly West, Kuruman, 25 m. N. of Colesberg) ; Transvaal Museum, 7 (Vryburg, Bloemhof, Fourteen Streams) ; South African Museum, 1 (Colesberg) ; National Museum, 1 (30 m. E. of Prieska). Total, 38.

2. Mirafra africanoides austinrobertsi White

Mirafra africanoides austinrobertsi White, *Ibis*, 1947 : 420 (*nom. nov.* for *Anacorys africanoides transvaalensis* Roberts, *Ann. Trl. Mus.*, 18, 1936 : 262 - Nylstroom ; *nec Mirafra africana transvaalensis* Hartert, 1900).

Inseparable in appearance from *M. a. africanoides* but smaller. Males are 85 % separable according to whether the wings are 90 mm and over or 89 mm and under. Mr. A. N. Rowan who kindly analysed the figures, tells me that the difference is statistically highly significant.

Range. — The northern Transvaal and western Rhodesia, north to the western Gwaai Reserve, where it meets the next form.

Measurements. — 8 ♂♂ : Wing 85-93 mm, av. 89.9 ; tail 45-58, av. 53.1 ; culmen 15-17, av. 16.0 ; tarsus 18-20, av. 20.1.

2 ♀♀ : Wing 84-87 mm ; tail 46-49 ; culmen 15-16 ; tarsus 19-22.

Material examined. — National Museum, 6 (Chatsworth, Bulawayo, Coplestone, Gwaai Reserve, Nyamandhlovu) ; Transvaal Museum, 5 (Border of Bushveld, Olifants River, Warmbath). Total, 11.

3. Mirafra africanoides vincenti (Roberts)

Anacorys africanoides vincenti Roberts, *Ostrich*, 1938 117 - Umvuma.

Synonym : *Mirafra africanoides mossambiquensis* Pinto, *Bol. Soc. Est. Mocamb.*, 22, 1952 5 - Maquese, Alto Changawe.

Another rather poorly defined form, but the ground colour above is paler and yellower than *austinrobertsi* and the streaking not quite so heavy above , more speckling on the throat

Range Rhodesia, from Wankie to Umvuma and Marandellas ; and southern Portuguese East Africa. Intergrades with *austinrobertsi* at Copleston and Nyamandhlovu.

Measurements. 19 ♂♂ : Wing 85 94 mm, av. 90.3 , tail 48 57, av. 53.4 ; culmen 14-18, av 16 1 ; tarsus 18-23, av. 21.0.

5 ♀♀ . Wing 78 86 mm, av 84 0 ; tail 46-53, av 50 0 ; culmen 15-16, av. 15.4 ; tarsus 19-23, av. 21.6.

Material examined. National Museum, 12 (Coplestone, Wankie, Gwaai Reserve, Selukwe, Marandellas, Funhalanso) ; Transvaal Museum, 4 (Umvuma, Alto Changane) ; Durban Museum, 9 (Panda, Manhica). Total, 25.

4. Mirafra africanoides trapnelli White

Mirafra africanoides trapnelli White, *Bull B. O. C* , 64, 1943 : 21 Between the Kasisi and Litapi Rivers, Balovale, Zambia.

Very similar to the last two forms but rather paler and averaging larger.

Range Western Barotseland, from Sesheke to Balovale, but not the extreme west, where *maharikari* replaces it.

Measurements. 7 ♂♂ . Wing 89 95 mm, av. 91.9 , tail 46-58, av. 54.5 , culmen 15-17, av 16.1 ; tarsus 19 21, av 20.6.

1 ♀ : Wing 84 mm ; tail 50 ; culmen 15 ; tarsus 22.

Material examined. National Museum, 8 (Balovale, Loma, Chiolola). Total, 8.

5. MIRAFRA AFRICANOIDES MAKARIKARI (Roberts)

Anacorys africanoides makarikari Roberts, *Ann. Tvl. Mus.*, 15, 1932 : 28 Nkate, Bechuanaland Protectorate.

A grey form, with buff edges to the feathers above, decidedly paler than any of the preceding subspecies.

Range. The north eastern Kalahari, north to the western Sesheke and Senanga Districts of Zambia, where it meets *trapnelli*. Overlaps in the south-west of its range, and again north-east of Maun, with *sarwensis* ; the second of these areas of overlap being probably due to off season movements of *sarwensis*.

Measurements. 30 ♂♂ : Wing 84-97 mm, av. 89.3 ; tail 45-61, av. 53.8 , culmen 14-17, av. 15.9 ; tarsus 19-23, av. 21.3.
13 ♀♀ Wing 82-88 mm, av. 85.4 , tail 48-57, av. 51.6 ; culmen 14-17, av. 15.5 ; tarsus 18-24, av. 20.6.

Material examined. — National Museum, 34 (Nata, 61 m. W. of Nata, 32 and 40 m. N. of Nata, Nangweshi, Bushman Pits, 70 m. E. of Maun, 80 m. N. of Maun, Tsotsoroga Pan, Ghanzi, Chiolola, 25 m. N. of Shangombo, Luete, Senanga, Nkate Road, Tsane) ; Transvaal Museum, 11 (Dekar, 30 m. S. W. of Sehitwa, Cungona, Tsumkwe). Total, 45.

6. MIRAFRA AFRICANOIDES SARWENSIS (Roberts)

Anacorys africanoides sarwensis Roberts, *Ann. Tvl. Mus.*, 15, 1932 . 27 - Kaotwe Pan, Bechuanaland Protectorate.

Synonym : *Anacorys africanoides ovambensis* Roberts, *Ostrich*, 1937 : 97-50 m. N. W. of Namutoni.

Redder and darker than *makarikari*.

Range. The central and north western Kalahari, west across northern South West Africa to about 15°E. Overlaps with *omaruru* on the Okavango and the south-east corner of the Etosha Pan ; and with *gobabisensis* in western Bechuanaland between 20° and 21°S. and 21° and 23°E.

Measurements. 60 ♂♂ : Wing 84-97 mm, av. 91.1 ; tail 49-62, av. 55.5 , culmen 14-18, av. 15.8 , tarsus 18-24, av. 21.1.

25 ♀♀ : Wing 84-96 mm, av. 88.1, tail 48-59, av. 54.3, culmen 13-18, av. 15.3 ; tarsus 18-23, av. 20.6.

Material examined. — National Museum, 111 (Hukantsi, Inkowane Pan, Kikomu di Kai, 18, 57 and 70 m. east of Kakia, 41 m. W. of Kanye, Kukong, Kofi Pan, Letlaking-Mashaweng road, Lothlekane, Lehututu, Lephepe, Lake Dow, Mache, Murumush, Molepole-Lephepe road, 80 m N of Maun, Odiakwe, Okwa, Sekhuma Pan, Serowe Inkowane Pan road, 13 m. N. W. of Serowe, Tsabong and 63 m. N, Tsepe, Tsotsoroga Pan, Tshane) ; Transvaal Museum, 35 (Xobi, Tsane, Hukantsi, Tierputs, 20 and 95 m. S. of Ghanzi, Kobi Pan, Dekar, Drotzky, 30 m S. W. of Seketwa, Aha Mts., Bohelolabaha, Damara Pan, Gemsbok Pan, Tsumkwe, Kaotwe, Kuke) ; South African Museum, 5 (Namutoni, Onoolongo, Onguma) ; State Museum, 1 (Onguma) ; Okavango Expedition, 4 (Runtu, Kapaku, Makamba, Omuramba Omutaka). Total, 156.

7. Mirafra africanoides harei Roberts

Mirafra africanoides harei Roberts, *Ann. Tvl. Mus.*, 5, 1917 : 258 - Windhoek.

Synonym : *Mirafra africanoides isseli* Hoesch & Niethammer, *J. f. Orn.*, Suppl., 1940 : 215 - Okahandja.

More heavily streaked and richer red than *gobabisensis*

Range — Central South West Africa from Otavi to Kalkrand, where it meets *gobabisensis*. Overlaps with *omaruru* in the Outjo area. Occasional birds from as far east as Barkly West and Francistown are indistinguishable.

Measurements. — 19 ♂♂ . Wing 87-96 mm, av. 91.4 ; tail 49-60, av. 55.1 ; culmen 14-17, av. 15.6 ; tarsus 19-23, av. 21.0

14 ♀♀ . Wing 85-92 mm, av 87.8 , tail 51-57, av. 53.3 ; culmen 13-17, av. 14.9 ; tarsus 18-23, av. 20.7.

Material examined. — Transvaal Museum, 15 (Windhoek, Okahandja, 22 m. E. of Dordabis, Tsumis, Quickborn, 10 m. W. of War Grave, Barkly West, Akangunde, Outjo, Otjiwarongo, Maltahohe Road) ; National Museum, 7 (20 m. S. of Letlaking, 15 m. S. of Tsabong, 22 m E. of Molepole, 92 m. S of Francistown, Tshane, 15 m E of Kakia) ; East London

Museum, 3 (Windhoek, Kalkrand) ; State Museum, 5 (Windhoek, Otjivarongo) ; Durban Museum, 4 (Windhoek, Okahandja), von Maltzahn collection, 4 (Otavi). Total, 38.

8. Mirafra africanoides gobabisensis (Roberts)

Anacorys africanoides gobabisensis Roberts, *Ann. Tvl. Mus.*, 18, 1936 : 263 - Gobabis.

Decidedly less heavily streaked above than *harei* ; paler, redder and less heavily streaked above than *africanoides*

Range. The southern Kalahari, from Gobabis to Olifantshoek and Upington. Intergrades freely with *africanoides* over a wide area of the northern Cape ; and overlaps *sarwensis* in southern Bechuanaland Protectorate.

Measurements. — 39 ♂♂ . Wing 86-98 mm, a. 93.2 ; tail 48-62, av 56.0 ; culmen 11-17, av 15 7 ; tarsus 17-24, av. 21.3.

15 ♀♀ : Wing 86-89 mm, av. 86 4 ; tail 50-57, av 54.2 ; culmen 13-16, av. 14.9 ; tarsus 19-23, av. 21.2.

Material examined. National Museum, 27 (Tsabong, 63 m. N. of Tsabong, Kukong, Kakia, Tsume Kikomu di Kai, 20 m. W of Kanye, Lokwabe, Lehututu, Murumusa Pan, Gobabis, Nkane) ; Transvaal Museum, 10 (Gobabis, 25 m. E. and 20 m W. of Upington, Kalahari Desert, Bohepabata, Aub-Nossop confluence) ; East London Museum, 20 (Tsumis, Witsand, Eindpaal, Kuruman Askham, Teekoms, Olifantshoek, Klipput) ; South African Museum, 4 (Morokwen, Upington, Griqualand-West) ; Durban Museum, 5 (Lidfontein, Prieska, Kuruman, Mata-Mata). Total, 67.

The details of the intermediates between *M. a. africanoides* and *M. a. gobabisensis*, which Clancey calls *quaesita*, are as follows :

Measurements. — 28 ♂♂ Wing 87 98 mm, av. 92.5 , tail 51-62, av. 56.4 ; culmen 15-19, av. 15 9 ; tarsus 18-25, av. 21.2.

15 ♀♀ Wing 84-95 mm, av. 88.5 ; tail 48-60, av. 54 5 , culmen 14-17, av. 15.7 ; tarsus 18-23, av. 20.6.

Material examined. — Durban Museum, 14 (Rietfontein (type), Riverton, Kuruman) ; East London Museum, 18 (Mat-

zap-Volop, Klipput, Witsand, Kalahari Game Reserve, Witdraai) ; South African Museum, 5 (Witdraai, Modder River) ; National Museum, 5 (Riverton, Kimberley, Witdraai) ; Transvaal Museum, 1 (Niekerkshoop). Total, 43.

9. Mirafra africanoides omaruru (Roberts)

Anacorys africanoides omaruru Roberts, *Ann. Tvl. Mus.*, 18, 1936 : 263 - Omaruru.

Synonym : *Anacorys africanoides tsumebensis* Roberts, *Ostrich*, 1937 : 98 - Tsumeb.

Less heavily streaked and yellower above than *harei* ; paler and more richly coloured than *sarwensis*

Range Northern South West Africa, overlapping *sarwensis* on the Okavango and eastern Etosha Pan and with *harei* in the Outjo area.

Measurements. 18 ♂♂ : Wing 85-98 mm, av. 91 9 ; tail 48-61, av. 54 3 ; culmen 14-18, av 15.3 ; tarsus 19-23, av. 20.9.

6 ♀♀ : Wing 84 94 mm, av. 89.1 ; tail 52-53, av. 52.7 ; culmen 15-17, av. 15.8 ; tarsus 20-22, av. 21.0.

Material examined. South African Museum, 9 (Omaruru (type), Onguma, 60 and 75 m. W. of Okakuejo, Otjivasandu, Kowares, Kameeldoorn waterhole) ; Transvaal Museum, 10 (Outjo, Orupembe, Ohopoho, Kowares, 30 m N. of Omaruru ; Okavango Expedition, 4 (Rooidag, Makamba, Omaramba Omutaka , National Museum, 1 (35 m W of Kang) ; State Museum, 1 (Kowares) , von Maltzahn coll., 1 (Erongo). Total, 26.

10. Mirafra africanoides rubidior White

Mirafra africanoides rubidior White, *Bull. B. O. C*, 75, 1955 : 29 - Ozondache, west of the Waterberg.

Heavily streaked on a rich, reddish-brown ground, much deeper and richer than in any other form.

Range. Only known from the type locality, and its range is entirely surround by that of *harei*.

Measurements. 2 ♂♂ : Wing 95 mm ; tail 60, 63 ; culmen 17 ; tarsus 22.

1 ♀ : Wing 87 mm ; tail 58 ; culmen 13 ; tarsus 20.

Material examined. Oxford University Museum, 3 (Ozondache (type)). Total, 3.

If we plot male and female average wing-lengths, the subspecies fall into two groups, a larger (*africanoides, rubidior, gobabisensis, harei, sarwensis* and *omaruru*), in which male wing lengths average from 91.4 to 95.0 mm and female

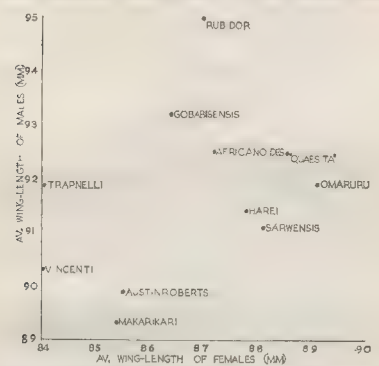


Fig. 2 — Average wing lengths of male and female of subspecies of *Mirafra africanoides.*

from 86.4 to 89.1 ; and a smaller *trapnelli, vincenti, austinrobertsi* and *makarikari*, in which the figure for male and female are 89.3-91.9 and 84.0-88.1 respectively. Only in males of *trapnelli* is there any overlap between the groups, of which the larger is distributed in the south and west and the smaller in the north and east.

RESUME

Révision, basee sur 178 peaux, des différentes sous espèces jusqu'ici décrites de *Mirafra africanoides*, desquelles 10 seulement sont retenues, encore que 4 d'entre elles (marquées d'un astérisque) peuvent être discutées

M. a. africanoides Smith,
M. a. austinrobertsi White *,
M. a. vincenti (Roberts) *,
M. a. trapnelli White *,
M. a. makarikari (Roberts),
M. a. sarwensis (Roberts),
M. a. harei Roberts,
M. a. gobabisensis (Roberts),
M. a. rubidior White,
M. a. omaruru (Roberts) *.

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ERRATUM

N° *spécial 1965*, article G. Niethammer, p. 100, 4ᵉ ligne du Résumé : au lieu de : « type *cinclus* à ventre pâle », lire : « type *cinclus* à ventre foncé ».